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Organic Gardening

Latest Developments in Plant Culture

VOL. 17, NO. 6 DECEMBER, 1950

IN THIS ISSUE

Forum		2
Home and Hobby Shop		8
Answer to Our Critics (Part IV)	J. I. RODALE	10
Plant for Winter Color	E. HAMILTON FAIRLEY	14
Winter Gardening	WILLIAM H. EYSTER, Ph.D.	16
Medicine from the Soil	JOHN B. ROUTIEN, M.D.	18
Organic-Grown Strawberry	WILLIAM H. EYSTER, Ph.D.	20
Men of Organiculture — Rudolf Steiner	HERMAN POPPELBAUM, Ph.D.	24
Frazer Products	JOSEPH W. FRAZER	27
Hardy Evergreen Vines	CHARLOTTE M. HOAK	30
December Decor	ANN ANDREWS RODALE	34
Our Soil Problem	ERIC EWESON	35
Walter and the Bean Stalk	WILLIAM H. EYSTER, Ph.D.	38
Florida — California	RUTH RODALE	39
Florida's Stricken Waters — Part IV	HOMER G. SHOCKLEY	40
December Garden Calendar	WILLIAM H. EYSTER, Ph.D.	41
Miscellany	J. I. RODALE	44
How About an Elm	RUTH RODALE	47
Research in the Organic Method	RUTH RODALE	49
The Earthworm	SUSAN BARTLESON	50
Christmas Rose	WILLIAM H. EYSTER, Ph.D.	52
Hints for the Vegetable Garden		55
Hints for the Flower Garden		56
New Books		58
Bulb of the Month	CHARLOTTE M. HOAK	58
Readers' Correspondence		59
Hollies		Inside Back Cover

THE COVER

Christmas rose *(Helleborus niger)* is a member of the Buttercup Family of plants. The flowers of this winter-blooming plant resemble roses. They grow best in shade, as in a fern bed or shrubbery border. *Photo by Generous.*

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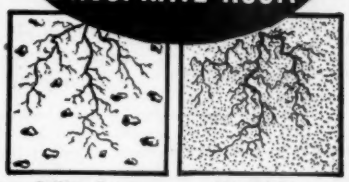

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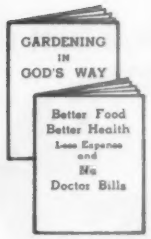

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Leaf Mulching

There has been a great deal written about the value of leaves for mulching purposes, and I sincerely agree in all respects.

I live on the outskirts of the City of Tacoma, Washington, and every fall gather maple leaves from the city streets. I usually haul about 10 trailer loads or approximately 20 yards every year. Incidentally, I find it much easier to gather these leaves directly after a rain, because when they are wet they are easier to gather with your fork.

Up to this time I have used these leaves exclusively for mulching my raspberries, however, I am now going to use them in the rest of my garden since they have proved so very successful.

When the raspberries are through bearing I take out all the old canes and chop them up in lengths of about 2 inches and scatter them over the ground as evenly as possible. Then after the new canes have made their growth, I cut them back to the desired height of about 5½ feet. And these too are cut up in the same manner and scattered between the rows. Then I put a layer of compost made from leaves and all the other compost material. I put this in between the rows about 2 inches deep. Next I take my spading fork and loosen the ground with a sort of rolling turn. (Never use a spade or shovel as this will cut and harm the roots.) Next I put a 10-inch layer of leaves over the entire raspberry patch. With this protective cover, the roots are protected from danger of frost during the cold months of winter. I might add, that I have never had a cane freeze while using this covering blanket of leaves.

When the buds start in the Spring,

I take my fork and rake the leaves and compost back from the canes so the new canes will grow up straight. Last fall when I cut back the canes, they averaged 14 feet high. My berries have always been large and sweet, but last year they were extremely so, for they had a delicious, smooth, mild flavor due to compost. These are the New Washington variety, having fruit spurs, or laterals, starting 8 inches from the ground and on up the stalk. These lower spurs or laterals, lay on the blanket of leaves and are kept clean from dirt and dust. When a picker drops some berries, or if they are knocked off the bushes, they can be recovered and saved, for they are just as clean as if freshly picked. The leaves also protect the picker from dirt and soot while kneeling down picking low berries. Where berries are not mulched, the lower spurs often bend to the ground and the fruit is ruined due to splashing mud when it rains.

Since I have relied entirely upon compost, instead of commercial fertilizer, in my berry field I have noticed that the worms multiplied by the thousands. And I am sure all readers are aware of the value of angleworms in the soil.

I would be very glad to hear from any of the large family of *Organic Gardening* readers and perhaps exchange ideas, for it is the help of one another that will enable us to learn and advance.

N. Muzzy
1402 So. Proctor St. Tacoma, Wash.

Health Food from A Poor Gravel Soil

We had been going so much that almost anything would seem good if there was to be any permanence to it and a rest from a continual newness. It was in this frame of mind that we started to garden on this gravel-infested, turpentine-fir ground. Folks came over and told us that the ground was too poor to grow anything; that they had tried it and failed. They pointed across the street to poor sickly-looking trees that at one time had the appearance of living but now were anything but alive.

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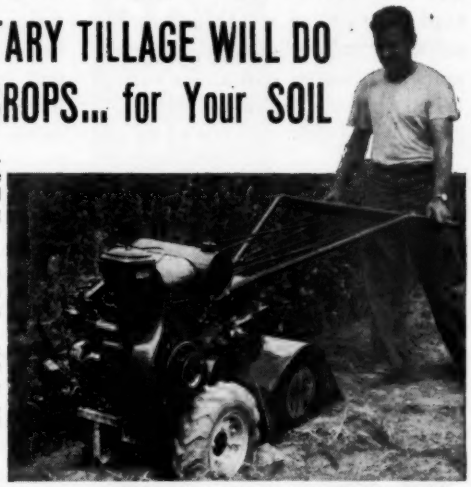

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But that did not deter us and we kept on grubbing and rolling up the carpet of fir needles which over the years had matted into a nice carpet. When this was rolled off we saw a gravelly soil that did not seem any too promising for the growth of vegetation. But by composting things began to change. To start with we had carrots and beets that would have easily taken the prize for diminutive vegetables. They were really too small to peal or prepare. But one will put up with things on his own place that he would rebel against at any other place. Each year showed improvement. In several years a neighbor was looking over in surprise and we heard her say to someone: "Just look at what they are taking off their land, where does it all come from?" Soon a neighbor who cared little for gardening became interested and began to "set out" trees, etc. One neighbor said that Mrs. Holton must have been born under the right star. They simply could not understand it. Perhaps they did not know what constituted good vegetables; but a couple of years ago some friends who had lived in Japan for years, and who "thot" in that language came and had dinner with us. They had seen real gardens in Japan and when they told us that we had some of the finest things they had seen we felt that we had something to check on. Both he and his wife remarked about the delicious soup which was plain vegetable soup, a thing they cared little for. They asked for a second helping. We had celery that measured 36 inches in length, — that is the length from the roots to the tip of the plant. Some of our beans were 17½ inches long and an inch and a half wide. And the best of all was the good flavor and the realization that it was as good in quality as Nature produces. After all, it is health that we want, but while we are getting it why not get a taste-thrill as long as it can be had.

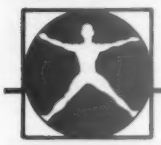
John A. Holton
10930 S. E. Powel Blvd.
Portland 66, Oregon

Leaves as chicken litter

A quick and effective way to compost leaves is to use the chicken yard. Spread the leaves an inch thick over the surface of the yard, sprinkle with water to keep down dust, and then scatter a few handfuls of scratch grain. The chickens will

Soil and Health Foundation
Contributions to this Foundation are deductible from Income Tax Returns.

Cancer?



CAN IT BE PREVENTED

By J. I. RODALE

The 13 articles which ran in recent issues of *Organic Gardening* have now been collected into handy booklet form for wider distribution. Here are the startling facts on how cancer is caused and how it may be prevented.

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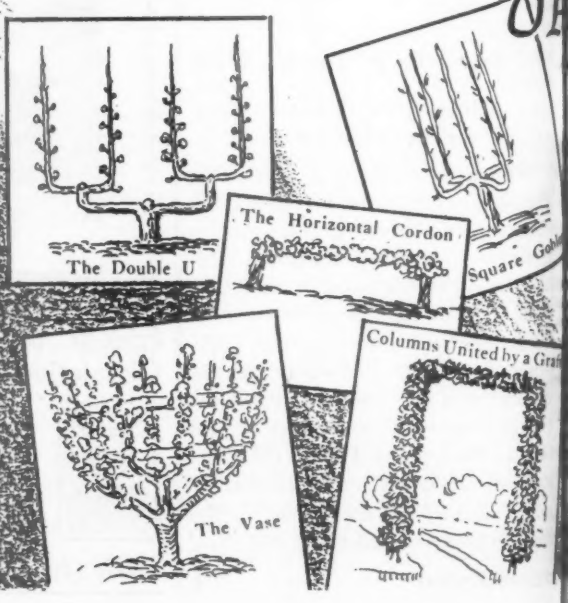


work over the entire area scratching for grain. In about a week the leaves will be shredded and mixed with manure. Apply another layer of leaves and so on until the compost is ready to use.

James Sherwood
500 S. Elam Ave., Greensboro, N. C.

Tall Garden Stories

B. O. G. M. (before organic gardening method) my ground was so hard and the soil so poor that I could hardly produce enough to pay for the seed, let alone the cost of plowing, cultivating, etc. (there was no cost or effort in harvesting). Last summer, under the organic method, I had undreamed of success, especially with my tomatoes. A neighbor sent her daughter over to buy 5 pounds of tomatoes and I had to refuse to sell her any as I didn't want to have to cut one.

And corn! ! well, it grew so tall that gathering it for roasting ears presented a major problem. Fortunately for me a telephone linesman lived in my community and I was able to borrow his pole climbing spikes, otherwise I would not have been able to gather it.

H. A. Cheek
1219 Clay Ave.
Charlotte, N. C.

Mosquito Netting for Collecting Leaves

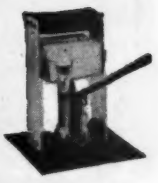
For collecting leaves, cut a piece of mosquito netting about twelve feet square. Spread it on the ground and rake 10 or 15 bushel of leaves onto it. Pick the netting up by the four corners and throw it over the shoulder like a large bag. The netting is light and strong. A large yard may be cleared of leaves in a few minutes.

M. B. Short
Minoa, New York

Composting with goats

The goat is a natural leaf-eater. In fact, he will eat grass only if leaves are unavailable. With a goat

20% more juice with the KK juicer



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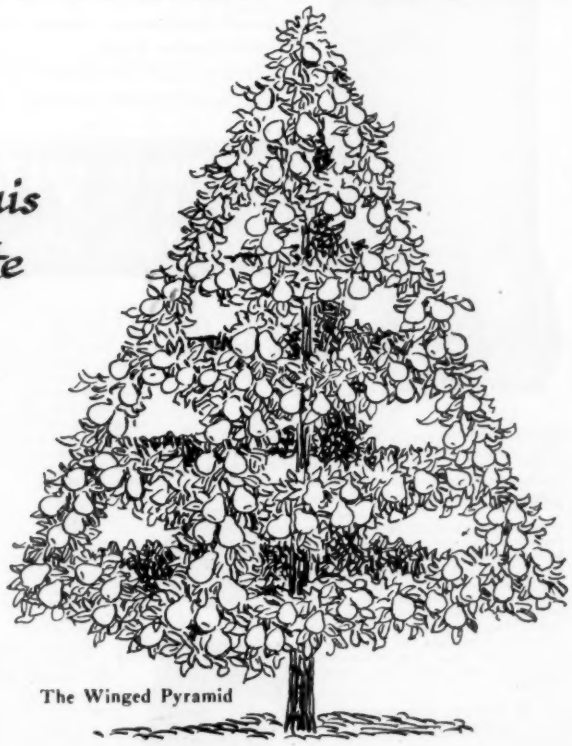

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hether you are starting with young trees or wish to adapt or neglected specimens to a more productive way of life, the e system is a MUST. Organic Gardening is proud to publish e U.S. a book that has gone into eight editions in France three in England. Every chapter is a revelation! Wherever it been introduced, the Lorette method has found a host of usiasts. Now YOU can be the first gardener in your vicinity ply THE LORETTE SYSTEM OF PRUNING. 240 pp., profusely trated. $3.00. (Postpaid if each accompanies order.)

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Address .....
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or two for helpers, one can compost down a great amount of any and all organic matter, including paper, rags, and sawdust. Use leaves as litter with the goats, so that their manure will activate the mass. Some of the leaves will be eaten, but will be eventually composted. Yes, goats can make leaf-gathering and utilization a very profitable activity for any small landholder.

H. C. Norton
417 West 9th St., Pueblo, Col.

Mulching, Pro and Con

This month we are again printing some of the glowing, or otherwise, letters that were sent to us recently about mulching experiences. With every letter that expressed doubt of the mulching method, we have added probable reasons for failure.

Haven for Earthworms

I have mulched my peach trees and berry vines for 25 years. Five years ago I gave up all cultivating and hoeing. I have ¼ of an acre that had been ruined by bad farming. You should see it now. All the mulch and cut up corn stalks make a wonderful food for worms. The ¼ acre is just alive with native worms.

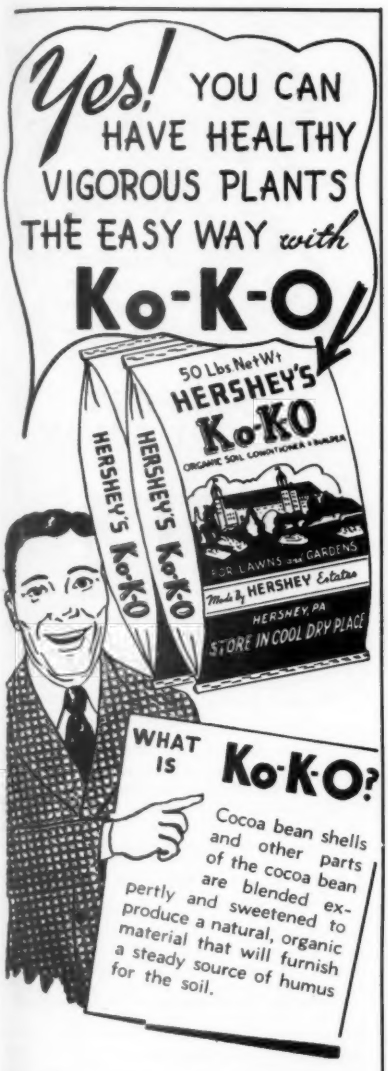
We get very few bugs except for Japanese beetles. These I collect in a can of kerosene. DDT, no. I think too much of the bees.

Thanks to organic matter and Tanglefoot, I have had no peach borers for 6 years.

Harvest with your index finger

Yes, we too can verify what a mulch can do to a garden or crop. We planted six rows of potatoes amounting to two bushels of seed and cultivated them a few times. Then we bought two truck loads of ground up corn cobs and mulched the plants about five inches deep.

When rain was scarce for three weeks this summer, the ground got as hard as concrete. But when you stepped on the mulched soil, your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ORGANIC SOIL CONDITIONER & BUILDER
FOR LAWNS and GARDENS
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Cocoa bean shells and other parts of the cocoa bean are blended expertly and sweetened to produce a natural, organic material that will furnish a steady source of humus for the soil.

FOR LAWNS AND GARDENS

- **Apply Direct to the Soil**
- **Mix in the Compost Heap**
- **FEED TO EARTHWORMS**

An essential material for the Organic Gardener . . . A slow-acting, long-lasting energizer that increases and replenishes the organic content of the soil . . . Improves soil texture . . . absorbs and retains plant-nourishing moisture . . . helps decomposition of soil . . . loosens clay soil.

Packed in Handy 50 lb. Bags

If your dealer cannot supply you we will ship direct to you where Pick-up and Delivery is available; if not available shipped to nearest freight station. Freight prepaid East of Mississippi River.

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Send $1.90 for each 50 lb. bag; enough for 200 sq. ft. of NEW lawn or garden. Minimum Shipment 100 lbs. (2 bags)

(Write for freight rates West of Miss. River)

HERSHEY ESTATES
HERSHEY, PENNSYLVANIA

foot actually sank into the ground. At the end of two months we could dig some of these potatoes with bare hands. All you had to do was to push aside the corn cob mulch and there, near the surface of the moist and mealy soil were your potatoes. I boasted to my friends that I could dig potatoes with my index finger, which I really did on this mulched ground.

Mulching and the Borers

We have had a heavy infestation of borers this year. We have found them in sunflowers, canteloupe, squash vines, delphinium, and Stokesia. Do you think mulching increases their prevalence?

(Editor's Note — We have found no increase in the prevalence of injurious insects in our mulched gardens.)

Raise fruit yields

We have been subscribers of your magazine for some time now. We mulch everything, fruit trees, berries, especially strawberries, and it pays off in a big way.

New Organic Gardening Clubs

Organic gardeners interested in becoming a member of a local *organic gardening club* should contact the person indicated if you live in or near one of the following locations:

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Mrs. Doris Wicklund
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St. Paul 6, Minnesota

Mr. Fred A. Veith
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Mrs. Philip C. Jones
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Mrs. F. M. Thomas
12404 Weddington St.
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Miss Barbara Beitzel
113 E. Orange Street,
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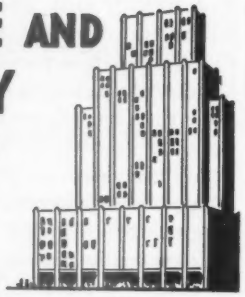

Miniature Gardenware

Window gardeners will be fascinated by this unique miniature window gardenware set. It consists of a brass scoop with wooden handle for tamping the earth, and an all brass trowel for "tillage." This set sells for $1.95 postpaid. Crane's, Dept. OG., 419 E. 57th St., New York 22, N. Y.

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You'll be amazed at the way your growing things *thrive* on BIO-GRO! It's absolutely NEW; a liquified organic fish fertilizer with added micronutrients. Nutritionally complete—neutral in pH—absolutely SAFE for all plants. ECONOMICAL, too. One pint makes 40 to 100 gallons of nourishing, pure liquid plant food.

You can get BIO-GRO from most seed stores; or order by mail. Pint cans $1.00; quarts $1.65; or half-pint trial size 60c—all postpaid. Write "BIO-GRO Div., Bioproducts."

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Snow Blower

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Watering Cans

New, colorful plastic pots feed or water plants from the bottom without the bother or expense of a wick. Designated the Fert-L-Pot, their artistic design means attractive, gift-class pieces of merchandise. Available in red, green, yellow and bronze, they come four to a package—all one color or assorted. $1.95 postpaid.

A delightful, long spout watering can is available in the same colors. They are offered in combination with pots (50 cents additional) or they can be purchased separately, four cans for $1.95 prepaid. Garden Craft, Dept. OG, Bridgeton 14, Ind.

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Answer to Our Critics

(PART IV)

Do chemicals give greater yields?

By J. I. RODALE

THIS is the fourth part of my answer to an article by Professor Ray Koon, head of the Waltham Field Station of the University of Massachusetts which was published in the May, 1950 issue of *Horticulture* magazine. Part I dealt with the question of whether organically produced food will give better health to the eater. The second article covered the question of whether there is enough green matter to go around if all farms practiced the organic method. Part III discussed the reason for the decline of old civilizations.

In the next part of his article Professor Koon says, "Today we fight famine with fertilizer and efficient farm management. We know that soils are unproductive if deficient in organic matter. So we try to maintain it at a high level, the farmer by turning under animal manures and vegetation; the gardener by adding the same, or peat moss, sawdust, leaves, pine needles and home made compost."

By "fighting famine with fertilizer" Koon means that chemical fertilizers will give greater yields than the method of fertilization the organiculturists follow. But he gives no proof—merely the bald statement that we can avert famine only if we use chemical fertilizers. This statement is so wrong that it is downright dangerous to the welfare of our country. It is a gross fallacy which must be demolished.

Organic Matter is Essential

Koon admits that, "Soils are unproductive if deficient in organic matter. So we try to maintain it at a high level." There are two damaging elements in this admission of Koon. First he admits that production, or yields, are tied in with organic matter. Soils, he says, are absolutely unproductive if deficient in organic matter. This is a well-known concept in agricultural literature. A typical case is that of the text-book called *Commercial Fertilizers,* by Professor Collings, 1938, in which he says, "The addition of farm-yard or green manures often produces crop yields much out of proportion to the quantity of nutrients added." Another one is *Farm Soils—Their Management and Fertilization,* by Edmund L. Worthen, 1941. Worthen states, "Organic matter is an essential constituent of agricultural soils. Their productivity is to a large extent dependent on it. So long as a soil is adequately supplied with fresh organic matter, good yields can be secured with comparatively inexpensive treatment." I could cite dozens of other references from conservative agricultural sources to the effect that without a good quantity of organic matter in a soil the yields would be depressed. Koon admits this, yet says that the organic method which stresses the maximum importance of organic matter will lead to famine. This is not consistent with fact nor theory.

Secondly, Koon said, "So we try to maintain it (organic matter) at a high level." Generally speaking, in connection with my observations of farming in this country, I would state that such an attempt is only half-hearted. There is some attempt to grow green manure crops but otherwise the average farmer never thinks in terms of salvaging waste organic matter which in so many cases are free for the taking. On a farm in which crops are regularly taken off the land, the growing of green manure crops each year are not sufficient to build up the organic matter. Where there are cattle to furnish manure, plus green manure crops, it would be different. There have been agricultural writings which stated that chemical fertilizers alone are sufficient for the practice of a good agriculture.

This is what Louis Bromfield said on this in his recent book *Out of the Earth* (Harpers): Most fertilizer companies, even at so recent a period as the 'Thirties, still followed the "short-cut, cure-all" psychology and advocated practices which had wrecked millions of acres of our good American soil and ruined countless farmers in the past. It was based upon the premise that it was possible to farm with commercial fertilizer alone, and it ignored the whole relationship between the availability of fertilizers as well as natural soil fertility to organic material and moisture."

Farmers Not Taught How to Use Organic Matter

This kind of teaching reacts unfavorably on the farmer who even when he is confronted with free organic matter does not know how to take advantage of it, because it is belittled by many agronomists who feel that we ought to use more scientific fertilizers. Witness two cases this spring. One farmer called me on the phone asking whether I

would like to have one hundred bales of spoiled hay. I could have them free for the hauling. The next morning another farmer asked me if I would care to have fifty bales for nothing. You can be sure that it did not take us long to send our truck for them. I gave each one of these farmers a free subscription to *The Organic Farmer* so that the next time they have spoiled hay they would know what to do with it. This is what comes out of the half-hearted utterances of the agricultural scientists about the value of organic matter. In the manner in which they say it the farmer knows that they are not too serious about it. They do not show him exactly how to go about getting more organic matter into their soil, or the technique of doing it. They do not rant and rave at him because he allows valuable organic matter to go to waste. By their tone of voice in print the farmer gets the impression that organic matter is something to be spoken about but not to plague oneself too much to get. So when a farmer has a young fortune of organic matter — one hundred bales of it—he lets it go up the flue and enrich my land.

There can be no question that organic matter will increase yields. There are ever so many references in the literature which show that plant mulches under fruit trees have doubled yields. E. Russell, in his book, *Soil Conditions and Plant Growth* (London, 1927) reports that "No combination of artificial fertilizers is as effective as farm yard manure in maintaining a high uniform level of crop production from year to year." I have before me the *Progressive Farmer* of February, 1950, which contains an article showing that trashy land farming doubled the yields of a farmer by the name of Buck Maples in Rising Star, Texas. Trashy land farming is the leaving of a dead cover crop on the top of the ground, instead of plowing it under. How many of you have seen farmers burning straw in the field instead of plowing it under? This is a sign that the farmer has not been educated properly by the agricultural educators in the matter of preserving organic matter. Koon talks of fighting famine with efficient farm management. Burning up straw and throwing away spoiled hay is not efficient farm management. Yet these are common practices in this country.

Fight Famine with Organic Method

Now coming to his statement that we must fight famine with chemical fertilizers, we organiculturists maintain that the best way to fight famine is to practice the organic method for in that way yields will be greatly increased, and will be greater than with the use of chemical fertilizers. I will now attempt to present data to prove this.

On January 8, 1948, Wheeler McMillen, editor-in-chief of the *Farm Journal* delivered a speech before the National Council of Farmer Cooperatives in Chicago in which he said:

Yields No Higher

The United States Department of Agriculture has been in existence for a little less than sixty years. Some of the state agricultural colleges and experiment stations are a little older.

Recently I had occasion to examine the history of crop yields during the last half-century while these institutions have been in operation. To obtain a comparison little influenced by the controlling effect of annual and cyclical weather variations, the fifty-year major field crops, those which occupied the largest acreage throughout the fifty years, were listed by annual yields. The yields from 1894 to 1919 were then compared with those from 1919 to 1944.

Only two of the eight averaged higher yields per acre during the second half than during the first half of the fifty years. These, ironically enough, were wheat and cotton, the two which are most often produced excessively.

The average yields from 1919 to 1944 were lower for six crops. These were flax, rye, barley, hay, oats and corn.

Average Yields of Eight Principal Food, Feed and Fiber Crops

	1894-1919	1919-1944
Cotton *	186.2	199.3
Wheat	14.1	14.3
Corn	26.8	26.6
Oats	29.7	29.3
Hay	1.29	1.27
Barley	23.5	22.1
Rye	12.9	11.9
Flax	8.6	7.4

* Cotton is pounds, hay in tons. Others in bushels.

What conclusion shall be drawn from these comparisons? Public moneys have been spent through the Department of Agriculture and the State Experiment Stations in scientific research. They have been spent through the Extension System and the Universities for agricultural education. Yet the average yields of only the surplus crops have risen, while the yields of six other primary food and feed crops have actually fallen.

The apparent result of considerable governmental expenditure, plus other efforts, is that we are falling a trifle short of holding our own in national average production per acre. Plant diseases, the insects, the forces of erosion and declining fertility are setting the pace.

In spite of gradually increasing expenditures by the farmer for chemical fertilizers the yields of many crops are declining. It is this very increase in the use of chemicals which is bringing about the disease in plants and erosion in the soil which is depressing the agricultural production. And so long as the agricultural experimental stations adopt the general attitude of Professor Koon and do not experiment with the organic method, more and more millions will go down the research drains before, some day, a national agricultural disaster will overtake the land and make such research mandatory. While Koon is saying that chemical fertilizers are wonderful, Congress has thrown a little shadow on them by authorizing a resolution that their use should be

investigated. The National Granges have also passed a resolution to the same effect. Where there is smoke there must be fire.

Here is a quotation along the same line of thought from a book called *The Business of Farming* by Degraff and Haystead (University of Oklahoma Press—1948):

"The Ohio scientists estimate that with the crops now grown in their state and the inadequate soil-maintenance programs now followed, the soil productivity of Ohio is declining six-tenths of one per cent each year. If this rate is continued over the next fifty years, the result will be a one-quarter decrease in soil productivity and a roughly comparable decrease in crop yields. Ohio is not alone in this trend. Probably few states are doing better, and surely many states are not doing so well."

For whatever it is worth I wish to present the following information. In the *Milbank Memorial Fund Quarterly*, vol. 28, 1950, appears the following: "During the decade 1938 to 1948 the available per capita food supply of the world decreased by about six per cent." This is according to figures obtained by the Food and Agricultural Organization of the United Nations. This is in a period where the statistics of chemical fertilizer usage shows a tremendous increase.

In the figures as presented by Wheeler McMillen above there is hidden an interesting factor. The yields would even be less—much less—with the use of chemical fertilizers if it were not for a certain practice. It seems that after a certain variety of seed is grown for a few years, its potency begins to decline. This is what Sir Albert Howard, the father of organiculture, called the dying out of the species. There is not enough health perpetuated in the seed of the crop to give it vigor enough to beget sufficient progeny. But where crops grow in a soil rich in organic matter and minerals there are infused in the seed some of the valuable biological qualities that are present in such a soil, and an organic farmer can use his own seed with a great saving to himself. The chemical farmer does not as a rule use his own seed. He purchases it from a special seed grower who sees to it that his soil is rich in organic matter. The ordinary farmer is penalized because something has happened to his soil due to the use of chemical fertilizers which forces him to dig down deeply into his pocket each year for seed money. *That* credit on his ledger is actually a reduction in his yield.

New Varieties from Agriculturally Primitive Countries

But that is not the main point that I would like to make. Because of this gradual dying out of the species our agricultural scientists are continually forced to breed new varieties that yield more, or that are more disease-resistant. How did they do this? They usually go to some primitive country like Nicaragua or Porto Rico, where practically no chemical fertilizers are used and look for healthy breeds which they cross with domestic varieties and then the result is hailed as a scientific miracle, whereas in a great many cases they hide the failures of scientific agriculture. The irony of it all is that at the same time that the plant geneticist goes to one of these backward countries seeking for likely varieties to work on he is sometimes accompanied by a soils man who teaches the natives to use chemical fertilizers. If this trend continues and gradually all the primitive countries begin to use chemical fertilizers, where will the plant geneticist of the future go for the basis of his new varieties. He will be up against a dead end unless he goes to those of us who have been practicing the organic method. We will be glad to hold the fort for them. So please do not attack us too hard, chemical men, for some day you will be badly in need of us. We must therefore charge off part of present day yields to this leaning on a source which may not last forever. If it were not for the hybrids that have been developed the yields would have declined much more severely.

Shrinking Crops and Midget Oranges

In California over fifty years ago it was not unusual for an oat crop to yield 75 bushels to the acre. Today the average is 25. California is a state that has been near the top in the use of chemical fertilizers. But trouble is ahead for it because of that fact. Take the case of the mystery of the shrinking oranges. Here is a typical newspaper statement: "California growers are baffled by the strange dwarfism that has overtaken their Valencias." There is a reason for this retrogression in the trend. After a bout of intoxication a headache usually sets in and agriculture is no exception. Chemical fertilizers are a stop-gap, a shot-in-the-arm, and consistent use of them is bound to lead to headaches. For four years now, Valencias have been shrinking in size until they are at present the size of golf balls, so that the advertising men who have the problem of selling these small oranges are at their wit's end. You read absurd advertisements like this: "Midgets are loaded with juice—buy a big bagful of small oranges." There are several orange growers in both Florida and California who are following the organic method and the size of whose oranges consistently are much larger than the average for their section.

Nutrients from Natural Minerals

Do not overlook the fact that the organic method takes in the use of phosphate rock instead of superphosphate. Much experimental work has been done comparing the effects of these two fertilizers on a comparative basis. Some show one to be superior and some show the other, depending on various conditions, but on the average superphosphate does not outyield phosphate rock, otherwise why would the State of Illinois in 1949 use only 27,129 tons (year) of superphosphate against 360,257 tons of phosphate rock? It is a known fact that phosphate rock is made more available by the presence of organic matter in sufficient

quantity. The experiments in which phosphate rock and the super are compared are not necessarily performed on soils which have had the benefit of very much organic matter. If experiments could be done where the land has been farmed by the organic method the difference in favor of the phosphate rock would be more spectacular.

Here is an example of one of these experiments done on an ordinary piece of land, that is, it has not been farmed by the organic method. I am quoting from an article by J. Francis Cooper in a recent issue of *The Agricultural News Service* of Gainesville, Florida:

"Doubled herbage yields, subsequent tripled animal gains and other nutritional effects were indicated when certain phosphatic fertilizers were applied to pangola grass pastures on a sandy Florida flatwoods soil, Dr. E. M. Hodges of the Florida Agricultural Experimental Station told the Southern Agricultural Workers annual meeting in Biloxi, Mississippi. This week — Rock phosphate applications gave the highest herbage yield, averaging *8174* pounds per acre in 1948 and 1949. Held under uniform conditions for the area, but receiving no phosphate, the experimental pasture produced *3538* pounds of dry herbage per acre annually. Where 300 pounds per acre of super was added the dry herbage yield was raised to *5508* pounds, while super and lime combined gave *6469* pounds per acre."

Phosphate rock gave	..	8,174 lbs.
No phosphate "	...	3,538 lbs.
Superphosphate "	...	5,508 lbs.
Super and lime "	...	6,469 lbs.

Here is an item of unusual significance which appeared in the column entitled "For the Farmer" in the *Detroit News* of January 17, 1950, written by John Merrifield.

"The University of Illinois, where the famous Morrow Plots experiment has been going on since 1876, lands on which corn has been grown continuously have produced less than 15 bushels per acre when treated with chemicals only.

"Plots treated with stable manure, ground limestone and rock phosphate have grown 61 bushels an acre.

"And identical soils treated with the same minerals and manures, plus plowed-under clover crops each three years, averaged 97 bushels.

"Experts agree the extra yields come through the action of bacteria which thrive in soils well supplied with organic matter. It is also a theory that foods grown on such soils are more nutritious."

Here is an item from the Louisville *Courier-Journal* of Dec. 29, 1948:

"Kentucky's corn champions were announced yesterday by the University of Kentucky. Everett Simpson, Bullit County, won the one acre division by producing 180.9 bushels of corn. The university termed unusual the fact that Simpson used no commercial fertilizer on his corn."

Rothamsted

It is amazing how unfair our critics can sometimes be. Time and time again we see in print a reference to the famous British experimental plot at Rothamsted, England in which experiments were carried on over a good part of a century, growing wheat with chemical fertilizers and also with stable manure, and the opposition invariably states that the yields from the chemical plots were greater. This is absolutely incorrect. Let me quote from the U. S. Yearbook of Agriculture *Soils and Men*, 1938, page 811: "In long-continued experiments at Woburn and Rothamsted in England, it has been found that stable manure has maintained the fertility of the soil over much longer periods than has the use of chemical fertilizers containing nitrogen, potash, phosphorus and sulphur. The numerous chemical elements contained in the manure are undoubtedly an important factor in this observed maintenance of fertility." On the same page, this book says, "the secondary elements in leafmold, particularly manganese, are in a very available form." Why doesn't the opposition experiment and find out?

Organic Fertilizers Come to the Front

Here is a typical item from a newspaper — *The Oklahoma Times* of December, 1950, headed by the paper, "Organic Fertility Comes to the Front":

"A farmer near Stigler, Oklahoma tried a little experiment. On a measured field he grew Kobe lespedeza for two years, and on another one of like nature he used 200 pounds per acre of 5-10-5 fertilizer — one of the most popular mixtures now in use.

"He then planted corn on the two fields. On the Kobe ground he got 68 bushels per acre and on the field treated with chemical fertilizer he got 21 bushels per acre.

"After all, you can't beat Mother Nature."

Where is there the slightest sign in any of these references that we all would starve unless we used chemical fertilizers? But there is plenty of evidence that the exact opposite is true. If we continue to use chemical fertilizers indefinitely, then some time in the future, I cannot say when, the land will absolutely be unable to furnish enough food to feed the country. The topsoil will have completely eroded. The land will have become too hard. There will not be enough trace mineral elements. The constitution of the soil will be completely off balance. The labor of farming will not pay for what comes out of it.

In my own case, by farming on organic lines, I have been able to attain yields about 40 per cent higher than the average figures for my section as furnished to me by the state each year. There is going to be no famine on the Rodale farm. And the tendency shows an increase from year to year.

Here is a typical letter we received from readers of our magazine:

"I attended a grape-grower's meeting in Penn Yan last week at which one of the 'experts' from the Gen-

(*Continued on page* 54)

Arbutus unedo—Strawberry Tree

Photo by FRANCIS

PLANT FOR WINTER COLOR

Bright green leaves and colorful fruits.

By E. HAMILTON FAIRLEY

IN GARDENS large or small, there are places where a group of shrubs having red berries during the fall and winter months will make an interesting garden picture with their warmth of color.

In planting shrubs along a walk or driveway consider their future growth and place them far enough back, so the branches will not become stunted looking by being repeatedly cut back as they grow out each year.

Where the climate is mild the following shrubs will flourish:

Strawberry Tree

An ornamental large evergreen shrub is *Arbutus unedo* known as the strawberry tree. It has handsome dark-green leaves and clusters of small white flowers, which resemble lily-of-the-valley, and red strawberry-like fruit which gives the shrub its common name. The flowers and fruit appear simultaneously during the winter months and the fruit is edible. The ultimate height of this shrub is about ten feet.

Cotoneasters

There are shrubs that have distinction and character, and fit certain positions in the garden, while adding beauty and interest to it. Sometimes a suitable background enhances their value. Such shrubs are found in the family of Cotoneasters, which supply the garden with some choice specimens, both tall and low-growing. *C. lactea* (*parneyi*) makes a handsome evergreen shrub with arching branches that in winter is covered with incredible quantities of bright red berries. During spring clusters of white flowers decorate the shrub. May be used as a specimen or grouped with other shrubs.

Cotoneaster horizontalis, or the rock spray may be used in many positions in the garden. The small round leaves turn a brilliant red in the fall and they, with the red berries, make a fine mass of color. It is useful in the rock garden, to train against a wall, to plant under windows, and as an edging to a border of shrubs.

Cotoneaster procumbens grow from eight to ten inches. It makes a good ground cover to plant at the

side of garden steps, it also has many other uses. This group of shrubs may be used extensively. The tall-growing ones for screening and in shrubberies, as hedges, and foundation planting.

Hollies

The Hollies are ornamental shrubs wherever they are found, and decorate gardens in many parts of the world. Ilex cornuta is considered the oldest Chinese Holly in cultivation. It was introduced into Europe as long ago as 1846. It will grow into a large shrub, and the handsome green leaves make a fine background for the bright red berries. It may be planted in a sunny position. It likes a rich soil with plenty of humus in it, and to be well watered during the growing season. When planted in full sun the flowers and berries are more abundant. *Ilex cornuta femina* is grown from cuttings taken from plants that produce a generous crop of berries.

In Southern California these shrubs are bought in one gallon and five gallon containers and with careful treatment may be planted at any time during the year. Slit the sides of the container and lift the shrub out carefully so as not to break the ball of roots.

In digging the holes, make them three times as deep and wide as the ball of roots. This is not wasted effort, for it will supply a soft root run of rich soil for the roots to work in, and make satisfactory growth. In the bottom of the hole put six to eight inches of well decomposed compost, add a shovelful of rich soil to this and mix well. Mix some well-decayed compost with soil for filling in around the ball of roots. Set the shrub in position and be sure it is straight. Fill in with soil to a few inches of the level of the ground. Now let a stream of water run in to settle the soil and avoid air pockets. Fill with more soil, and draw soil up to form a well around the shrub for holding water. Irrigate the shrubs every third day if the weather is hot, until they are established, then once a week or once in ten days. A thorough soaking is better than a daily sprinkling.

Photo by FRANCIS

Cotoneaster lactea

Photo by FRANCIS

Ilex cornuta—Chinese Holly

WINTER GARDENING

Continue your garden during the winter with cool-temperature vegetables.

By WILLIAM H. EYSTER, Ph.D.

AS WINTER approaches, most of the common garden vegetables either produce seeds and die or withdraw more or less completely to underground quarters for the winter. Those which grow from seed and produce seed again in the same growing season are called *annuals.* Those which grow from seed and produce a fleshy root with a small crown bearing a cluster of leaves which are held close to the soil are called *biennials.* Some common annuals are corn, beans, peas, tomatoes, peppers, eggplant, and pumpkins.

Some biennials are tender and must be removed from the garden before the ground freezes in the autumn, as beets, turnips, rutabaga, and onions. Other biennials may be left in the ground during the winter and used in early spring, as parsnip, carrot, and winter onion. The vegetables which are to be left in the garden soil over winter should be mulched to prevent excessive freezing of the soil. With proper mulching, almost any of the fleshy-rooted vegetables may be over-wintered right in the garden.

Asparagus

Asparagus is a wholesome, early spring vegetable. It seems to do best in locations having winters sufficiently cold to freeze the ground to a depth of at least a few inches. The latitude of southern Georgia is about the southern limit of its profitable culture. The plants should be cut off at the ground level in the fall and the tops allowed to remain on the soil as a winter mulch. Since asparagus plants are heavy feeders it is well to apply a liberal amount of compost over the soil and work it in lightly before laying down the winter mulch. It may be necessary to remineralize the soil by adding phosphate rock and potash rock at the rate of ½ pound of each for each square foot of soil. The soil need not be mineralized oftener than once every five years. If the plants show signs of rust or have been attacked by the asparagus beetle, the tops should be shredded and put into the compost heap and some other plant materials should be used as a winter mulch over the asparagus bed.

Horseradish

Horseradish is most commonly grown in some out-of-the-way place in the garden. It is perfectly hardy and is well adapted for growing in the north temperate regions of the United States. It requires no particular winter care. It might be well to stake the plants so that roots can be dug in early spring before new growth begins.

Dandelion

The dandelion is hardy and adapted for growing in almost any garden soil. It is best grown in beds with the plants in rows about 18 inches apart. In colder parts of the country it is desirable to mulch slightly during the winter using leaves, straw, strawy manure, or any mulching material which will not pack. Before putting down the winter mulch, apply a thin layer of compost between the rows and work it into the soil lightly. Early the following spring the plants will be ready for use as greens. The leaves may be blanched, if desired, by covering the plants with paper or by placing two boards set in the form of the letter "A" over the row.

Kale

Kale, or borecole, is hardy and lives over winter in latitudes as far north as Pennsylvania and in other locations where similar winter conditions prevail. It is an all-year plant since it is also resistant to heat and may be grown in summer, but its real merit is as a cool-weather greens. In northern regions where it lives over winter the last sowing should be about six weeks before frost in order that the plants may become well established. It may well follow green beans, potatoes, peas or some other vegetable that has occupied the soil during the summer and early fall. A light winter mulch applied after the ground is frozen will help keep the plants vigorous and insure a good growth in early spring.

Spinach

Spinach is by far the most popular of the greens It is a reasonably hardy cool-weather plant that withstands winter conditions throughout most portions of the South. In colder portions of the Southern States it may need some protection during the winter, for, like cabbage and other hardy crops, it is sometimes severely injured or even killed by low temperatures. In most portions of the North spinach is primarily a late fall or early spring crop, but in localities where summer temperatures are mild it may be grown continuously from early spring until late fall. Spinach responds well to compost. A pound of compost mix-

ed with a half pound each of phosphate rock and potash rock makes an excellent fertilizer for the spinach plants. This mixture should be raked into the soil lightly. With some protection, as cold frames, spinach can be grown in winter even in the North. Also cloches are ideal for keeping spinach and other greens in production throughout all or most of the winter.

Corn Salad

Corn salad is also known as lamb's lettuce and fetticus. It is a good late winter or early spring vegetable. For an early crop the seed should be planted during the autumn and the plants covered lightly with a winter mulch. In the Southern States the winter mulch is not necessary, and the plants are ready for use in February and March. Corn salad is used as a salad in place of lettuce, or mixed with lettuce or water cress.

Endive

Endive is another all-year plant as it is a cool-weather plant and is not sensitive to heat. In the South it is mainly a winter crop. In the North it is grown during the spring, summer, and autumn and is also forced during the winter. Endive is often known on the markets as escarolle. For winter use in the North, plants should be removed from the garden with a ball of earth, placed in a cellar or cold frame where they will not freeze, and tied and blanched as needed.

Lettuce

Lettuce should be grown in every home garden. It is a cool-weather crop, being as sensitive to heat as any vegetable grown. In the South lettuce culture is confined to late fall, winter, and spring. It thrives in any rich soil, but will not tolerate acid conditions. In preparing the soil, add lime if necessary and a mixture of compost and phosphate rock so that each square foot of soil gets one pound of compost and a half pound of phosphate rock. This mixture should be raked into the soil lightly. In no case should fresh manure be used. Most commercial varieties do well in the South in winter. For northern gardens, sow a variety of winter lettuce which is highly resistant to low temperatures.

Parsley

Another winter vegetable is parsley which is hardy to cold but sensitive to heat. If given a little protection it may be carried over winter throughout most of the North. After the plants are established they thrive in almost any kind of soil. Since the plants are delicate in their early stages of growth, the soil should be mellow and free from clods and stones. Enrich it with compost to which phosphate rock and potash rock have been added. The seeds germinate slowly, but organic matter in the soil will hasten germination greatly.

Water Cress

Water cress is one of the few vegetables that can be grown in wet surroundings. In the more moderate portions of the North it grows practically the year round, and winter is its best season in the South. It grows best in water from springs in limestone regions. A supply for an entire family may be grown in a small spring-fed brook or a series of shallow pools where the water is about one foot deep. Care must be taken that the water is clean; otherwise the cress is not fit for use. Water cress may be started from seed or from pieces of plants. It pays to prepare the soil by enriching it with a mixture of compost to which has been added pulverized lime, phosphate rock, and potash rock. Early spring is the best time to start a water cress planting.

Jerusalem Artichoke

This plant is really a sunflower, and may become a troublesome weed if care is not taken in its culture. It can be grown in practically all parts of the United States. It is started from pieces of tubers in the same way as potatoes. The tubers are not injured by freezing and may remain in the ground over winter.

Shallot

The shallot is a small onion of the Multiplier type. In its requirements it is similar to other onions; and as the bulbs have a more delicate flavor than most onions, the plant is well worth attention in the garden. They seldom form seed and are propagated by means of the small cloves or divisions into which the plant splits during growth. The plant is hardy and may be left in the ground from year to year, but best results are to be had by replanting the smaller ones at the desired time.

Dilution of soil samples in water.

Adding antibiotics to eggs to test the activity against germs growing there.

MEDICINE FROM THE SOIL

Soil organisms manufacture antibiotics.

By JOHN B. ROUTIEN, M. D.

EVERY gardener knows about the activities of earthworms, bacteria, molds and other organisms in the soil. You know how some of these decompose dead plant and animal remains to liberate chemicals that can be used again by the next crop of plants, how others fix nitrogen of the air and make it available for plant roots, etc. But have you ever thought of how these microorganisms, such as molds, live together? As you would expect, they compete with one another for food. Some of this food consists of dead plant parts in the soil, but in some cases one fungus can feed upon another. Some fungi, moreover, can feed upon minute animals such as nematodes.

Antibiotics and Soil Organisms

This competition for food, of course, will regulate what fungi can live in a soil and how many fungi there will be. Obviously, the treatment of the soil, such as addition of chemical fertilizers or organic fertilizers, the addition of lime, etc., will affect the numbers of molds present and their activities. The fungi prefer a somewhat acid soil, and are replaced by actinomyces and bacteria as the soil approaches a neutral reaction.

In addition to this competition for food, oxygen and space in the soil, there may be another important factor in operation. It seems quite possible that some fungi produce substances called *antibiotics,* which help them in their fight for life in the soil. These antibiotics are chemicals produced by one organism that are harmful to another; they will either kill the second organism or keep it from growing. Some fungi have been used to prevent various plant diseases; when the antibiotic-producing mold is added to the soil, it keeps the disease from developing. Since at least half of the fungi of the soil produce some antibiotic substance, it seems quite possible that the fungal population of the soil, at least, is governed partially by the production of the antibiotics. And since animal life, also, is affected by antibiotics, it seems possible that the nematodes, protozoa, earthworms and other small animals may be influenced by these substances produced by molds. All of this will affect the growth of the plants in the soil.

These ideas are of interest to farmers and gardeners, but the first application of antibiotics was in the field of medicine. Sir Alexander Fleming, in 1929, was the first to see the possibility that one of these antibiotics might be used to kill disease germs in our bodies. From his work and that of others came the wonder drug, penicillin, that has proved to be so valuable.

Penicillin, however, was not a cure-all, and various laboratories began an intensive search for other antibiotics that could be used against germs that penicillin would not affect. These efforts resulted in a number of new antibiotics, but most of them could not be used in human diseases because they would harm the body. There are a few, though, that were safe and are now being given to patients.

Terramycin, the newest antibiotic, gives promise of great usefulness in our treatment of many diseases. It was discovered by a team of workers

A pure culture of a solid mold.

at the Biochemical Laboratories of Chas. Pfizer and Co., Inc., in Brooklyn, New York. This company is the largest producer of penicillin and streptomycin, but we saw a definite need for other antibiotics and started a program to find any that would be useful.

Prospecting for New Antibiotics

Where do we look for these new antibiotics? Since penicillin is made by a mold, called *Penicillum chrysogenum*, and streptomycin is made by another mold, called *Streptomyces griseus*, and since our best chance was to secure a great number of different kinds of molds and test them for their ability to produce an antibiotic. As molds are to be found in greatest numbers in the soil, we went there for our start. Through the help of friends, acquaintances, business representatives, members of the armed forces, etc., we received each week a number of small samples of soil from all over the world. Every state in the Union is represented in our collection, and we have samples from all countries but Russia. These samples were taken from leaf mold, woods soil, vegetable and flower gardens, grain fields, grassland, cemeteries, roadsides, compost heaps and other types of soils.

Pure Cultures

To produce an antibiotic we must have a *pure culture* of the mold — that is, one kind of mold growing by itself. There are many thousands of molds and bacteria in the soil, so we had to separate each mold from the others and study it alone. The method used is one in which we dilute a sample of soil with water until in each drop there are just a few mold cells. This drop is smeared over a nutritive substance of about the consistency of firm jelly; in this substance are carbohydrates, proteins and minerals necessary for the growth of the molds. (The first steps in this process are shown in the photographs.) Several drops from each of many soils are smeared on the food materials in the Petri dishes so that we may have a large number of molds from which to choose.

The dishes containing the jelly-like food are left for several days in a warm room so that each mold can grow and form a *colony*. (A colony is a small mass of mold looking much like the spots of mold we sometimes see on bread, jelly, preserves, etc. Mold colonies are of different colors, shapes and sizes. By these differences we can distinguish various types and decide what kinds we wish to study.) Then we put a small amount of a colony into a tube that contains more of the solid medium. (In one illustration can be seen two technicians in this process of *isolating* cultures. The tips of the needles they use are heated till red-hot to make them sterile and then are used to pick off one of the colonies seen in the Petri dish on the table. The colony is spread over the slanted nutritive medium in the tube so that it will grow rapidly. In another illustration is a single tube containing the mold after it has grown for about a week.) The mold will grow entirely alone in the tube and we have the *pure culture* that we were working for.

Testing for New Antibiotics

After thousands of molds in pure culture have grown in the tubes for a week or so we put each of them into another tube of medium that is liquid, not solid. Here the mold will grow, also, and perhaps will make an antibiotic that it will secrete into the liquid. This liquid next is tested to see whether there is any antibiotic. A few drops of it are added to a pure culture of some germ causing a human disease, or a disc of paper may be dipped in the liquid and then placed in a Petri dish where the germ is present. If this germ fails to grow, it means that there was an antibiotic in the liquid. By other tests we can tell whether this antibiotic is one we have found before or whether it is a new one.

Suppose that a new antibiotic *was* produced. One of the men in this team of scientists at Pfizer's receives a culture of the mold and grows it in hundreds of gallons of the liquid medium. He gets from this liquid, after a lot of hard work, a small amount of pure antibiotic. It is tested in test tubes, Petri dishes and even in eggs against many kinds of harmful germs to see whether it will kill them, and it is also tested to make sure that it will not be harmful to humans. If the antibiotic passes these tests, it then is produced in great quantity so that samples can be sent out to doctors to try in diseases that so far they cannot cure. If the antibiotic does what we wish, more of it is made in huge tanks, purified, packaged very carefully under sterile conditions and distributed to drug stores for use when the doctor prescribes it.

Thus we see another function of the amazing molds of the soil. Not only are they important in the fertility of the soil itself, but we can find in the soil molds that will help us fight our battles against disease germs. But we are not yet content. We need other antibiotics, and the idea that spurs us on as we start studying new soils is the thought that *maybe* one of these soils is *the one!*

ORGANIC-GROWN STRAWBERRY

Strawberries can be a profitable garden crop.

(Photos by R. Isler. Courtesy of Schweitzer Garten)

By WILLIAM H. EYSTER, Ph.D.

THE strawberry is doubtless the most popular garden fruit. It thrives in almost any kind of soil so long as it is well drained and abundantly supplied with humus and the minerals which are essential to vigorous growth and fruiting. Because good drainage is so essential, the strawberry prefers a slight slope and a sandy loam or gravely soil rather than a heavy soil where the soil is level. Since moisture is exceedingly important, a loose soil underlain with clay should be chosen for the strawberry whenever such a soil is available. However, moisture can also be assured by maintaining a rather high content of humus in the soil.

Preparation of the Soil

Too much emphasis cannot be put on the proper preparation of the soil for your strawberry planting. The soil should be loosened in early fall with a rototiller or disk so that the plant cover may be worked into it. The soil should then be remineralized by adding a mixture of phosphate rock and potash rock at the rate of a ton per acre which is about one-twentieth pound per square foot of soil surface.

If compost is to be used as the source of organic matter, an application of five tons per acre or about one-fourth of a pound for each square foot of surface. The compost should be spread over the soil and worked into the upper few inches. As a protective cover for winter, seed the soil with a cover crop such as rye, winter vetch, or Siberian kale; or apply a winter mulch of shredded plant materials which is free from weed seeds. In the spring the cover crop should be worked into the soil to still further increase its organic matter. The mulch should be raked out of the row spaces and allowed to remain on the soil between the rows as a mulch.

The compost may also be made right on the surface of the soil where the strawberries are to be planted. In this case the soil should be loosened with a disk or rototiller or plowed lightly and leveled with a harrow or other instrument. In the garden the fulcrum fork may be used for loosening the soil. The composting materials should then be spread over the soil in early fall so that they will be more or less completely composted the following spring. For such a sheet compost, put down from three to six inches of finely shredded plant materials including leaves of trees, alfalfa or clover hay, pea vines, or whatever plant materials happen to be available in your region. Over this layer of shredded plant materials, spread a mixture of equal parts of potash and phosphate rock at the rate of two tons per acre which is about one-tenth of a pound for each square foot of soil surface. If fresh manure is available, apply a sprinkling over the shredded plant material to act as an activator. Or. a sprinkling of compost may be used as an activator which will hasten the composting process.

By making the compost on the soil in which the strawberry plants are to be planted, all the products of decomposition will naturally enter the soil and become available to the growing plants. This sheet of composting materials will also protect the soil during the winter against erosion and the soil organisms from the low temperatures. Under this mulch, the soil organisms will remain more or less active all winter long. In the spring the sheet composted materials will be worked into the soil lightly some weeks before the time for planting the strawberry plants.

How to Plant

The spacing of the plant varies with the cultural practices to be followed. If the plants are to be allowed to form matted rows from one to two feet wide, the rows should be spaced about four feet apart and the plants spaced about 18 inches in the row. If the plants are to be limited to "hills", the rows need not be more than two feet apart and the plants spaced about 18 inches apart in the row. Where space is limited, as in the small home garden, the plants may be grown closer together providing the soil is highly productive and has an abundant source of moisture.

Before setting a plant it is well to trim off all the dead or discolored outside leaves and to clip off the tips of the roots. This practice tends to remove diseased parts of the plant and to greatly increase the number of absorptive roots. Since the strawberry roots are relatively short and fibrous, the stimulation of root growth is highly important. An abundant root growth and a goodly amount of humus in the soil which absorbs and holds large amounts of water insure the strawberry plants the moisture they so much need for

good growth and fruit production.

The plants should be set in the soil the same depth at which they grew before transplanting them. This is highly important. Do not plant them less deep and do not plant them deeper. If the crown is covered with soil, the plant will surely die.

When to Plant

Early spring seems to be the best time of the year to set out strawberry plants, although many growers plant also in early fall. Spring-planted strawberries should not be allowed to fruit the first year. Every week or ten days, the flowers should be removed to prevent the setting of fruit. Fall-planted strawberries should be mulched between the rows and a light mulch should also be placed over the plants after the plants have been forced into dormancy by the low temperatures of late autumn or early winter. The mulch prevents the alternate freezing and thawing which tends to lift the plants out of the soil. This is important as a large percentage of the plants of an unprotected patch could be destroyed in this manner.

Cultivation

Strawberry plants are shallow-rooted. They absorb the plant's nutrients from the upper few inches of the soil. Injudicious cultivation could destroy so many of these feeder roots that the plants may be so weakened that they become unproductive. If cultivation is practiced, it should be very light close to the plants but may be somewhat deeper between the rows if that is necessary in the control of weeds.

Mulching is doubtless a better practice for the control of weeds and the conservation of moisture than cultivation. The mulches used should be free from the seeds of plants which might create a weed problem. Strawberries cannot tolerate the competition of weeds. Choose such mulching materials as sawdust, hop wastes from breweries, shredded straw of cereals and legumes, shredded leaves of trees, pulverized corncobs, almond or peanut shells, cotton hulls, and shredded bark. These mulches should be applied in layers thick enough to prevent the growth of all weeds. Mulches also conserve moisture in the soil, keep the soil cool, feed and protect soil organisms, and keep the fruits free from soil.

Fig. 1

Plants grown with a complete fertilizer are normal and vigorous with a maximum yield of berries free from rots.

Nutrition

As in all green plants, the first and most fundamental process in nutrition is the making, in the green leaves, of sugars and starches from water taken from the soil by the roots and carbon dioxide taken from the atmosphere by the leaves. The energy used in making sugars and starches in the strawberry leaf is sunlight. Because of this, the process is commonly called *photosynthesis* by botanists. Just about 95 per cent of a strawberry plant's bulk is made up of the products of photosynthesis. But to grow and to reproduce, green plants need nutrient elements from the soil. By adding these elements from the soil to the sugars made in photosynthesis, green plants build up proteins and many other kinds of complex organic compounds. The building of these complex substances from the more simple sugars is called *biosynthesis.* A strawberry plant makes its best growth and sets a maximum number of fruits when it has all the elements required.

Fig. 2

Strawberry plants grown with an excessive amount of nitrogen, made above normal vegetative growth but the plants and berries are highly susceptible to diseases. Many of the berries have rotted.

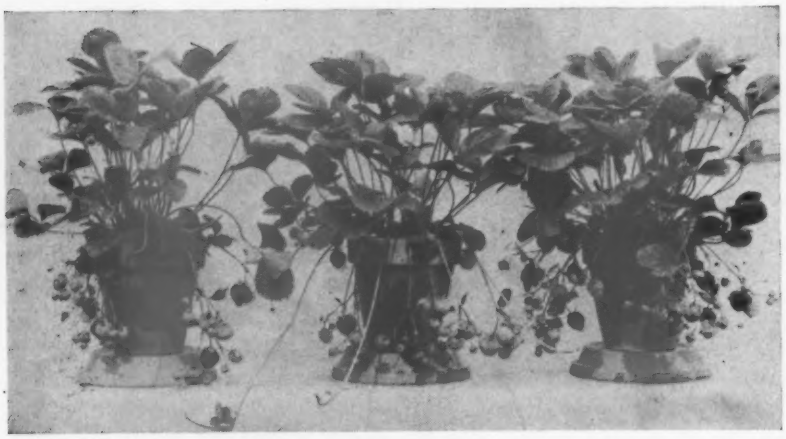


Fig. 3

Plants grown with all essential nutrient elements present, *except potassium*, are only slightly below normal in vegetative growth and yield. The plants were able to absorb from the soil potassium which chemical tests indicated as not available to plants.

Theoretically it is quite simple to supply the soil with all ten major and minor nutrient elements which are carbon (C), hydrogen (H), oxygen (O), phosphorus (P), potassium (K), nitrogen (N), sulphur (S), calcium (Ca), iron (Fe), and magnesium (Mg). These elements can easily be held in mind by writing them in the form of a cafe sign, as follows: C. Hopkn's Cafe, Mg, where Mg stands for mighty good.

Carbon is taken from the air in the form of carbon dioxide, a gas, through millions of microscopically small openings in the leaves called stomates or little mouths. Hydrogen and oxygen, which together form water, are absorbed from the soil by the roots.

The N-P-K-Ca Requirements

Nitrogen, (N), phosphorus (P), potassium (K), and calcium (Ca) are commonly regarded as the four major elements in plant nutrition. Let us see how these highly essential elements may be supplied to the soil.

Approximately 78 per cent of the atmosphere is gaseous nitrogen. In this form, nitrogen cannot be utilized by green plants. To be available to green plants, like the strawberry, the nitrogen must first be combined with oxygen, hydrogen, or other elements. It occurs in plant and animal residues, and is reduced to such soluble and usable compounds as ammonia (NH_3) and nitrate (NO_3). The series of changes in the composting process which convert the nitrogen-containing compounds into simpler compounds including ammonia is known as *ammonification*. It is easy to see that the amount of ammonia that can be produced in a soil depends upon the amount of raw organic matter that is placed in the soil for decomposition. Ammonification is brought about by organisms of decay including bacteria, fungi, and a variety of microscopically small animals. The ammonia unites with water in the soil to form ammonium hydroxide, and the latter reacts with acid ions in the soil solution to form such salts as ammonium carbonate and ammonium nitrate.

Ammonium nitrogen is then converted into nitrites by a kind of bacteria known as *Nitrosomonas*. The nitrites are then oxidized by *Nitrobacter* into nitrates. These two kinds of bacteria are known as *nitrifying* bacteria. They are anaerobic forms which means that they can live without taking oxygen from the air. The nitrates are soluble in water and are absorbed by the roots of the strawberry to be used in building proteins from the simple sugars.

A soil rich in organic matter also is inhabited by such nitrogen-fixing bacteria as Azotobacter and Clostridium. These bacteria, the former an aerobic form and the latter an anaerobic type, use the raw organic matter in the soil as food and are able to take nitrogen from the air and fix it and thus make it available to green plants. The amount of nitrogen which these bacteria are able to fix is surprisingly large. The nitrogen which results from the decay of organic matter plus that which is taken from the atmosphere and fixed by the nitrogen-fixing bacteria is sufficient to supply the strawberry plants with all the nitrogen required for healthy growth and abundant fruit production.

Strawberry plants which have all

Fig. 4

Plants grown in soil having all essential nutrient elements *except phosphorus* show a marked decrease in yield of berries.

the essential elements in good balance are shown in Fig. 1. These plants show normal growth and have the maximum fruit set. None of the fruits show a tendency to rot, and the plants are relatively free from all diseases and insect pests.

The plants shown in Fig. 2 have an abundant supply of nitrogen but the soil in which they were grown had a deficiency of some of the other essential elements. It should be noted that the plants have made an unusual vegetative growth, but the yield is not as good as in plants grown in soil with a good balance between nitrogen and the other nutrient elements. The plants showed a marked susceptibility to insect damage and to disease as indicated by the tendency of the fruits to rot.

The importance of phosphorus in the growing of strawberry plants is indicated by the plants shown in Fig. 3, which were grown in a soil lacking this element. It should be noted that the vegetative growth of the strawberry plants is practically normal but that the fruit set is much poorer than in the case of plants which are grown in soil containing phosphorus and the other essential elements. To make sure that the soil has a sufficient supply of phosphorus, phosphate rock should be added to the soil when it is prepared for setting the plants as already pointed out.

Although the plants shown in Fig. 4 were grown in a soil to which no potassium was added, the plants are practically normal as regards both vegetative growth and fruit set. Evidently this soil had a reserve of potassium in non-water soluble form which was made available by the root acids. A deficiency of potassium could lead to unfavorable growth and poor fruit set. This can be avoided by adding pulverized potash rock to the soil before setting out the plants, as already pointed out.

The effects produced by a deficiency of nitrogen on both vegetative growth and fruit set in the strawberry are strikingly shown in Fig. 5. Note that the plants are small and spindling, and that the fruit clusters consist of a relatively small number of small fruits. This indicates that in the absence of nitrogen, strawberry plants are unable to use the other elements even though they are abundantly present in the soil. This relationship indicates the great value of organic matter in the soil, the direct and indirect source of all the nitrogen used by the plants.

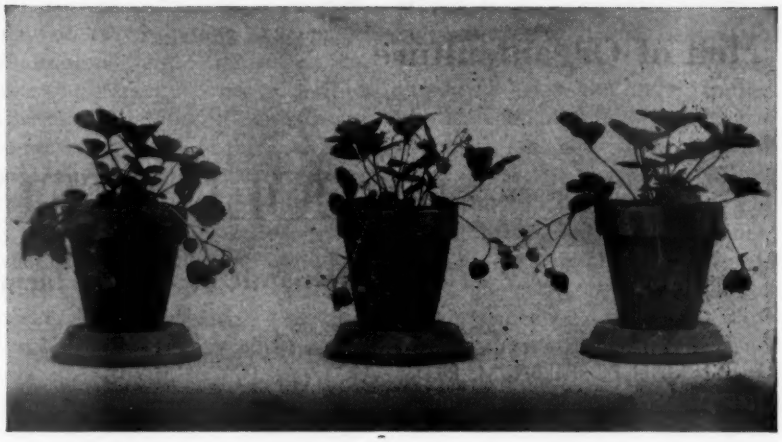


Fig. 5

Plants grown in a soil having all the essential nutrient elements *except nitrogen* make a poor vegetative growth and set few berries. Evidently in the absence of nitrogen, the plants are unable to utilize all other elements.

Strawbery plants simply will not grow well and produce a good crop in depleted soils, as shown by the plants in Fig. 6 which were grown in a deficient soil. It is a waste of time and money to make a strawberry planting in such a soil. In a soil of this kind, the essential element present in smallest amount in general determines how well the plants will grow and fruit. The element present in least amount becomes what is known as the *limiting factor* in growth. This means that if more of this element were added to the soil, growth would increase until some other element is present in least amount and thus becomes the limiting factor. The purpose of the proper preparation of the soil is to add enough organic matter and pulverized rocks to make sure that all the essential elements will be present in sufficient amounts to meet the needs of the growing and fruiting strawberry plants.

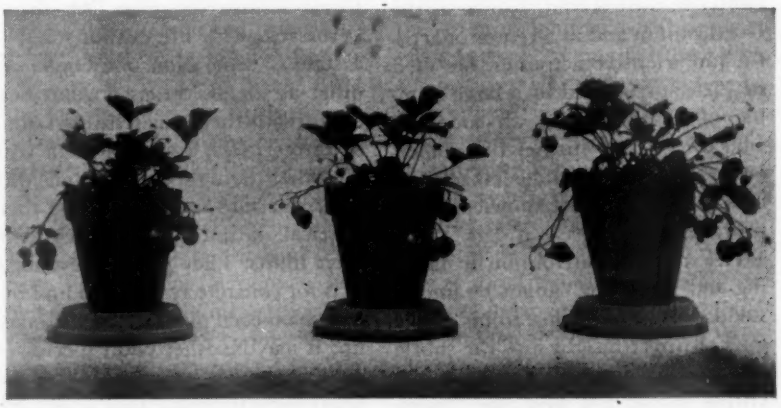


Fig. 6

Plants grown in a soil characterized as "poor soil," which doubtless lacks nitrogen as well as some of the other nutrients.

Men of Organiculture

RUDOLF STEINER

Bio-Dynamic method of farming.

By HERMAN POPPELBAUM, Ph.D.

RUDOLF STEINER, Austrian scientist and thinker, is known as the founder of "Anthroposophy" and its many practical applications, among which are the "bio-dynamic methods" of farming and gardening. He was born in 1861 in Kraljevec (then belonging to Austria-Hungary) and educated in and near Vienna. His scientific training was received at the University of Technology in Vienna, his main interests being the natural sciences and mathematics. To the country surroundings of his early youth he owed his knowledge of farming and industry, which was later on to enable him to give remarkable suggestions for the renewal of farming and gardening on the basis of deeper insight into the forces operating in living nature. The last twelve years of his life he devoted almost entirely to the building up of the School of Spiritual Science in Dornach, Switzerland, known as the Goetheanum and as a center of artistic and scientific activities. He died in 1925, surrounded by a large number of followers from all countries who try to carry further the numerous suggestions which he left to their care in many fields of knowledge and practice. (1)

His specific contribution to farming and gardening cannot be understood without reference to his native gifts of direct insight into the subtle interplay of invisible forces in the visible world. For him, the "living body" which underlies the material forms of plants, animals and man was perceptible as penetrating the "physical body" and representing its architect and continuous rebuilder. The plant lives in a continuous stream of changing substances taken in and given off again, which make the shape outwardly visible as they pass through it. What persists in the metabolism is not the matter itself but the "formative forces" which rule it. They maintain the shape in spite of the metabolism. This life-body (also called the formative forces body) builds the bridge between the different visible stages of the plant and connects them into a unity. But it also links the plant with the formative forces in the soil and the atmospheric surroundings and even with the extra-terrestrial agents, of which the sun is the most obvious representative. The whole plant world and the living soil are thus embedded in an invisible system comprising the sun, which in itself forms a huge organism. All things permeated with life do not stand in a state of separation one beside the other as lifeless things do, but bear about with them an invisible system of forces which connects them with all other living beings. Thus they interpenetrate each other, and their physical outline does not represent their limits. They project beyond it. It is for concrete research to find out with *what* each plant species is linked up: it may be other plant species, or substances in the ground or atmosphere even though found at remarkable distances. Similar "dynamic" relations also link the plant world with the living forces operating in animals and men. This was the picture which presented itself to the experience of R. Steiner from earliest youth.

Concept of Nature

His view of nature bears a certain resemblance to the ideas held by Goethe (1749-1832), but those ideas are restated with modern means of thought and made accessible to experimentation. The striking thing for the student of his writings is that he was able to speak authoritatively about a great number of fields of knowledge as though by direct acquaintance with the matter in hand. The conception of the world as a whole which is prior to the parts and must be considered if the parts are to be understood is common to both Goethe and Steiner. The difference lies in the enormous amount of concrete information which Steiner provided to fill in the over-all picture. These details are drawn from native observation, while his vast erudition provided him with corroborating material from contemporary science and literature. It is the details which give to his indications that astounding bearing on practice that has again and again filled experts and experimenters with wonder.

The reports of the Dornach Laboratories (Switzerland) contain a large amount of material which has become important for practical procedures. We mention only the research work of Lili Kolisko (2) and Ehrenfried Pfeiffer (3). Pfeiffer has also summed up his vast practical experience in his books, *Bio-Dynamic*

Farming and Gardening (1940), and *The Earth's Face and Human Destiny* (1947). See Bibliography (5).

Nature of the Earth

Steiner's conception of the earth as a whole can be confirmed with ordinary physical methods of research. In studying, for instance, the changes of temperature in the atmosphere one finds the well known regular change during day and night. But the atmospheric pressure does not follow this simple rhythm as one would expect; it changes regularly *twice* a day, attaining a minimum at three o'clock in the afternoon and a second minimum at three o'clock at night. All properties of the atmosphere — electric tension, ionization, etc. — show the same regular change, which reveals that they are the manifestations of a life process that comprises the whole of the earth and makes it a separate cosmic entity. Günther Wachsmuth who as the first naturalist followed in this an indication of Rudolf Steiner, drew attention to the remarkable unity embracing the earth and spoke of a breathing process which involves the whole earth organism. (4) Recently Wachsmuth has extended his research so as to include the remotest strata of the atmosphere, and has built the bridge to meteorological and cosmological research work of our day. See his comprehensive book *Erde und Mensch* (Zurich, 1945).

One can easily see that Steiner's contribution is by no means a matter of mere theory but changes the whole attitude of the practical farmer toward his tasks. Nobody who begins to understand that the earth is an organism which lives within the regular interplay of the forces and substances of its surroundings can fail to regard the *soil* as a particular part of this organism, as an *organ of the earth* so to speak. True, this organ is permeated with mineral matter and the processes which hold sway in it. But there is a continuous streaming of living forces to be found in the soil, and this counteracts the forces which tend toward mineralization. The processes in the soil must be understood as an interplay of two opposing tendencies: vitalization and mineralization. Every substance, whether mineral or alive, solid or liquid or gaseous, comes within reach of this interplay. Even air, light, and warmth become different after entering the soil. What is needed is an exact knowledge of what all these substances are doing inside the earth and what their function is when they emerge above the surface. There can be no conscious and responsible handling of anything in the realm of farming without this exact knowledge of "bio-dynamic" conditions.

Bio-Dynamic Method

Bio-dynamic research inquires into these riddles in close cooperation with the practical farmer and gardener. It is, therefore, not only interested in the question of better manuring and fertilizing but comprises a large body of information about the interplay of forces on the earth, within and around it. Of course, the new treatment of the soil in bio-dynamic farming could not fail to arouse more of a sensation than any of the other measures advocated, since the problems of soil fertility have recently come under vivid discussion.

The "bio-dynamic methods" originally arose from answers given by Rudolf Steiner when farmers in Germany and Austria asked his advice for the improvement of soil and crops. The first comprehensive information was embodied in a course of lectures given by him to farmers at Koberwitz in Silesia, June, 1924. The facts pointed out in this course and widely followed up later on in practice cannot in any sense be directly compared with the suggestions put forward by the adherents or opponents of certain methods of fertilizing. They are not mere material in the battle for or against artificial fertilizers, but far more comprehensive procedures with the aim of re-establishing natural conditions in farm and garden. The bio-dynamic methods comprise a great many steps which start from the careful consideration of the complicated interplay below and above the soil. R. Steiner's point is that the farmer and gardener should be led to the understanding of the realm of life which he has concretely to deal with. Modern farming has lost the instinctive wisdom which in former centuries has guided husbandry. Rudolf Steiner, from his concrete knowledge of this subtle interplay, helps the farmer and gardener to devise a practical plan for the improvement of soil and crop, for the establishment of healthy livestock, the cultivation of trees and shrubs and hedges, the fostering of birds and bees, and butterflies, and even of the earthworm.

Great progress has been made recently in devising laboratory methods to prove that "formative forces" are present in organic matter, the most efficient method employing the so-called sensitive crystallizations developed by Ehrenfried Pfeiffer following indications of Rudolf Steiner. A salt solution, preferably copper chloride, is left standing overnight on the plain surface bottom of a glass dish and protected from outside disturbance. It appears that the resulting thin layer of needle-shaped crystals shows a characteristic arrangement of its elements. If a drop of an organic fluid is added before the crystallizing begins, the pattern appears modified, so much so that Pfeiffer was able to draw conclusions concerning the nature of the fluid added from mere inspection of the crystal pattern. Students of the method can grow familiar with these patterns and use the method themselves for testing various fluids, as for instance, plant juices, or blood, or an extract from the soil or from various manures and composts. With sufficient practical experience — the method is teachable — a safe diagnosis can be made about the properties of soil, the health of plants, and the organic conditions of animals and human beings. In recent years, due to the growing interest among medical men, the method has proven of value for the diagnosis of various diseases. There can be no doubt that it has proven invaluable as a source

of advice for practical farming and gardening when it is applied to soil testing and crop evaluation (5).

B-D Production of Humus

A few remarks may be added about R. Steiner's specific advice concerning the "bio-dynamic" production of humus. In recent decades the soil has not been regarded as an *organ* containing and providing life forces, but merely as a *substratum* which has to transmit certain substances, especially salts, to the body of the plant. The usual modern treatment of the soil, which has its origin in laboratory experiments, starts from the question: what substances does the plant consume, what does it draw from the soil and what, therefore, are we to give back to the soil when it is exhausted? The loss of substance has to be made up if the balance is to be restored. The task becomes widely different when the soil is regarded as a transmitter of subtle life forces, as a kind of diaphragm which separates the spheres above and below the surface. Not only does matter have to be replaced but a healthy interplay of most intimate workings has to be restored. The soil has not merely to be replenished but, in a certain sense, cured of a latent illness. The carrier of this cure is humus. The living forces within it have to be strengthened to counteract excessive mineralization, and then have to be directed into the plants to keep them healthy. Soil and air, light and warmth must once more be allowed to form a mighty organism which pulsates around the plants and penetrates them so that they again may become the visible organs in the invisible body of the farm or garden. Since the soil is often deprived of life forces and spoiled through wrong measures (so that it is no longer "in good heart") it must be stimulated with new life. This is done by various preparations sprayed in remarkably small quantities over the soil and the plants, and by various specially prepared plant substances which are inserted into manure and compost heaps. Manure and compost become "earth" quickly and good earth at that. Rudolf Steiner entrusted to the farmers the ways by which these spraying and stimulating substances can be prepared. All of them are taken from nature, the raw materials being parts of common plants subjected to special treatment. These substances have come to be known as "Bio-dynamic Preparations."

Bio-Dynamic Preparations

As the methods of manufacturing these preparations are complicated and require a good deal of experience, a number of practical farmers in various countries have undertaken to supervise their manufacture and to guarantee their appropriate production. The preparations can be ordered from these "information centers" in almost every country by those who want to use them.† It goes without saying that the use of these preparations alone, apart from the many other necessary measures advocated by Rudolf Steiner will not go far enough in improving soil and crops. The information centers give advice as to the all-round consideration of what the individual farm or garden needs.

One of the most characteristic features about these preparations is their action in fine distribution. The quantity in which they are added to the soil or sprayed out over a large area matters much less than the quality which adheres to them by virtue of their careful production. In this they are comparable to the highly diluted solutions used by certain schools of medicine. It is for this reason that the action of the bio-dynamic stimulators is sometimes called homeopathic. Rudolf Steiner himself advocated high dilutions (so-called potencies) for the treatment of certain illnesses, although he never made it a matter of one-sided preference. He wanted to leave the problem of high dilutions to scientific experience. For him the task was to have the efficiency of such preparations practically tested in order to find out in which cases and to what extent they could be found working. Under his direction, Lili Kolisko (2), in the year 1923 and after, carried out a systematic inquiry into the effects of progressively rarified salt solutions upon germinating wheat. She was able to show that the efficiency of such dilutions fades away when the dilution surpasses the 10th or 12th decimal potency, but that the stimulating effect reappears when the dilution is carried further. By a simple calculation it can be figured out that in such high dilutions nothing "material" of the ponderable solute is left. The effect therefore must be called imponderable, that is, not based on the physical presence of the material salt in the solvent. The substance then exercises an effect which is merely dynamic. It is independent of the quantity used, yet dependent on the rhythm of progressive rarification.

Minute Quantities

In spite of the minute quantities (whose presence cannot be proven by chemical means) the effects on plant growth are clearly visible. Such findings can give an idea of the subtlety of the interplay of forces in the soil. It is quite possible that all principal effects in the realm of life are of this dynamic kind. Certainly the investigations of L. Kolisko and Pfeiffer go to show that the presence of infinitesimal traces of substances within the soil and in plants, and consequently also in the organisms of animal and man, may be of paramount influence on health and illness. The bio-dynamic preparations, however far spread-out or sprayed, may be rightly expected to work profound changes. The practical experience with their use bears out this expectation. A remarkable change in the condition of the treated soil occurs; it becomes more crumbly and fibrous and retains moisture more easily. The appearance of the crops is also improved; they become more resistant against drought and against infection. In short, the soil and crop show remarkable improvement, even

(*Continued on page* 57)

† In U. S. A. write to: Bio-Dynamic Farming and Gardening Association, R. D. No. 1, Chester, New York.

FRAZER PRODUCTS

Streamlining the making of compost with modern methods.

By JOSEPH W. FRAZER

Vice-Chairman of Board of Directors, Kaiser Frazer Corp.; Chairman and President, Graham Paige Corp.; President, Frazer Products, Inc.; President, Frazer Illinois Compost Corp.; Chairman, Frazer Farm Equipment Corp.

ALTHOUGH I have given the greater portion of my life to the manufacture and sale of automobiles, I was brought up on a farm, and my first interest, aside from business, has been in growing things.

For a great many years I have been alarmed at the rapidity with which our American soil has been depleted and at the uninterrupted march of pests.

By numerous experiments I learned long ago that the application of decomposed organic matter not only greatly increased the fertility of the soil, but also made plants so nurtured more resistant to pests and parasites. Therefore, when Mr. Eric Eweson, a biochemist, told me that after a period of twelve or more years of research, he had worked out a method of producing organic compost on a commercial scale, I immediately saw the significance and great potentialities of such a far-reaching development. As a result I organized Frazer Products, Inc. about three years ago.

The making of organic compost is as old as agriculture, but previous to Mr. Eweson's patented process, the method used was cumbersome and lengthy, in that once the organic waste materials had been partially decomposed, it was necessary to work them into the soil for further decomposition before the full benefit of the organic matter could be realized. By contrast, the Eweson process effects thorough decomposition in cycles of seven days.

At the time of the formation of Frazer Products, Inc., some of my friends and long time business associates joined me in financing our initial operations. We built a plant at Mt. Wolf, Pa., which was operating for more than a year, during which period we proved conclusively that our biochemistry was right. At the same time, however, we also proved that the handling of the material was very difficult and we did not have the answer to that because in the process of decomposition, the material changes form and becomes almost like gumbo mud. If it is allowed to solidify in a tank, it forms an adobe-like substance that has to be chiseled out with a crowbar or similar implement.

During the time our Mt. Wolf plant was in operation, I had several mechanical engineers and engineering firms visit the plant to see what, if anything, they could do to correct the mechanical difficulties we were experiencing. Unfortunately, we got no satisfactory answer from any of this group.

Having been in the automobile business for thirty-eight years, I knew the A. O. Smith Corporation of Milwaukee, Wisconsin, very well, since for many years they had supplied the industry with frames and other parts, and, needless to say, I had great confidence in their ability. Accordingly, I contacted Mr. Heath, president of that corporation, who became interested in our project, particularly inasmuch as they were making the Harvestore, to take the place of the old-fashioned silo. The Harvestore is made of glass-covered steel.

The A. O. Smith Corporation had patented a mechanical arm to remove material from the bottom of the Harvestore, and Mr. Heath felt that this same arm would work out satisfactorily in transferring our material from zone to zone and unloading the decomposed organic compost from the bottom zone of the digester, which steps are required in our process.

An arrangement was immediately consummated with the A. O. Smith Corporation to design our first commercial plant, which was erected by them in Union Stockyards at Chicago, Illinois, for our first licensee, the Frazer Illinois Compost Corporation.

The formation of the Frazer Illinois Compost Corporation is interesting, in that Mr. Frederick H. Prince, owner of the Chicago Stockyards, had seen some of our early publicity and sent some of his people to see me to find out if it would solve his manure problem. The Stockyards had 50,000 tons of manure a year in Chicago, which they had to ship out of the city by train. As a result of our conversation, I talked with Mr. William Wood Prince, who is president of the Union Stockyards and Transit Company, following which the Frazer Illinois Compost Corporation was formed with Mr. Prince and myself each putting up half of the paid-in capital.

As in the case of any new project, the cost of the Chicago plant, our

first commercial unit, including engineering and experimental work, far exceeded our original estimates, but finally the design was frozen and the plant was turned over to us by A. O. Smith Corporation some months ago. In other words, any and all so-called "bugs" in the mechanical equipment had been eliminated.

The Chicago plant has been in continuous operation since last December and we have experienced a tremendous demand for our product, with little or no publicity or advertising. A few months ago we spent $420.00 for two ads in *Organic Gardening* and *The Organic Farmer*, both of which are published by Mr. J. I. Rodale at Emmaus, Pa. As a result, we received some $35,000 worth of retail mail orders. During the first six months of this year, practically all of our production was sold direct to customers.

The retail prices of the 2-pound, 10-pound and 50-pound bags are shown here: 2-pound bag — $1.00, 10-pound bag — $2.00, 50-pound bag — $3.00.

The 80-pound bag has been discontinued, because two 50-pound bags can be shipped for the same freight charge as the 80-pound bag. The 2-pound package is mailed postage paid anywhere in the United States. All other prices are f.o.b. the plant.

There are two distinct markets for Frazer Compost — general farming and the city and suburban market, which includes flower and vegetable gardens, green houses, hot houses, lawns, cemeteries, golf courses, etc. It is this latter field which should be exploited until such time as a sufficient number of plants have been erected to provide adequate quantities for farm use.

Our Chicago operation has been so successful that Mr. Prince and I recently decided to enlarge our plant to a capacity of approximately 7,500 tons of Frazer Compost per year. This larger plant is more economical, in that a two or three digester unit can be operated with about the same amount of equipment and number of laborers required to operate the single digester of our present plant. In other words, the new, larger Chicago unit, which is to be completed and in operation before December 31st, 1950, will consist of three digesters and two raw material storage tanks.

Joseph Frazer

The digester is a glass covered steel tank with separate compartments in which various stages of decomposition take place. It is approximately 40-feet high by 14-feet in diameter. The compartments are separated by grids, on top of which is installed one of the A. O. Smith Corporation's patented mechanical arms previously referred to. This arm, under electric power, forces the material down through the grid into the next lower compartment. Heated air is forced up through the bottom zone, which contains the thoroughly decomposed material, to the upper zones, gathering CO_2 or carbon dioxide, and circulating it through the partially decomposed material in the upper compartments. It is the air with CO_2 which supports and hastens the decomposition process. Atmospheric air without CO_2 would arrest decomposition. Without air, putrefaction would result. It is this phase of the process which forms the basis of the Eweson patents. Only air that is heavily charged with CO_2 (carbon dioxide) is allowed to come in contact with the decomposing mass.

In the process of decomposition, the bacteria in the raw material generate approximately 155 to 160

degrees Fahrenheit. If, for any reason, it should reach a temperature up to 175 degrees, additional air is forced into the mass.

Any number of combinations of organic waste materials can be used. A mixture of approximately one part animal manure or sewage sludge to three parts cellulosic materials such as straw, pea vines, cannery wastes, cornstalks and cobs, tobacco stems, etc., or selected garbage — that is, without tin cans, metal, glass, wood, excessive amounts of newsprint, etc. — will produce compost in cycles of seven (7) days.

While the material being used in our normal operation at the Chicago Stockyards consists of the manure and straw which is taken out of the cattle pens, we have also run some sewage sludge and garbage through the digester. The finished product is essentially the same. At our Mt. Wolf, Pa., operation we used sewage sludge, pea vines, tobacco stems and some garbage.

The analysis of the total nutrients in Frazer Compost will vary around 2-2-2. Compost, however, cannot be evaluated simply by its initial N.P.K. content. Its principal function is that of creating additional plant food in proper balance and variety from plant residue and inert rock particles in the soil and from the atmosphere. Moreover, the nutrient value of compost is not lost through leaching as is the case, to a considerable extent, with water-soluble chemical fertilizers.

Our plans do not call for fortifying Frazer Compost with added chemicals.

Future plants will incorporate the same general specifications of the new, larger Chicago unit. The price of such a plant must be determined in each individual case, depending upon the location, equipment needed, size and type of building and labor and material costs which may be effective at the time a license agreement is negotiated.

The A. O. Smith Corporation guarantees the mechanical portion of the plant covering defective parts and workmanship.

Our license is issued for a term of ten (10) years with an option to renew for an additional ten (10) years.

In return for a royalty payment, Frazer Products, Inc. will furnish the licensee any bio-chemical assistance necessary to insure the success of our process. Frazer Products, Inc. will also furnish sales promotion and advertising assistance to insure the ready sale of the finished product.

We are now desirous of putting up plants elsewhere in the United States in order to introduce Frazer Compost and take advantage of the ready-made market for our product in every section of the country.

The need of organic matter in the soil is not disputed. Without it, cultivated land is soon depleted. The U. S. Department of Agriculture reported, in 1938, the alarming fact that no less than 253,000,000 acres, or 61 per cent of the total area then under crops, had either been completely or partially destroyed, or had lost most of its fertility.

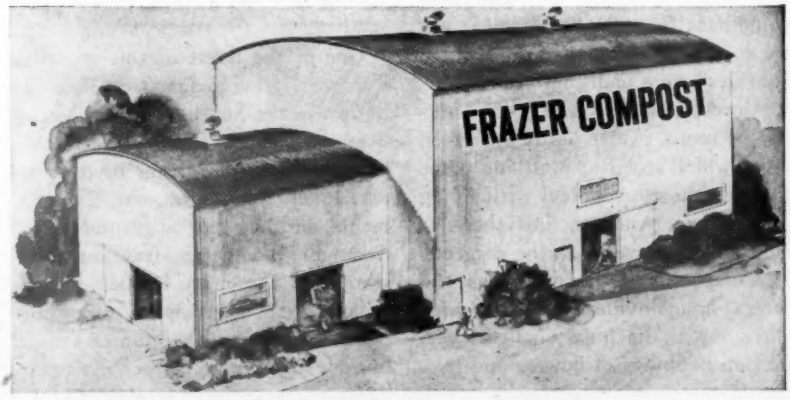
More recently the Ohio Experiment Station showed that continuous cropping to corn and cereals depleted two-thirds of the organic matter from a good silty clay loam within 20 years.

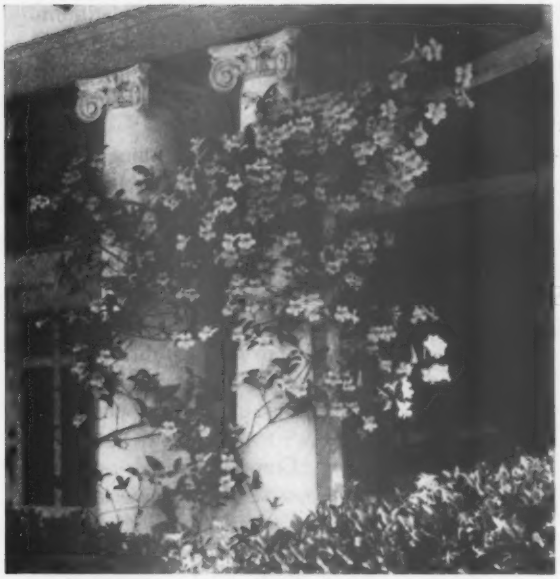
Only careful attention to the maintenance of organic matter can keep a good soil good. Only organic matter will rebuild worn out soil. FRAZER COMPOST will produce immediate, beneficial results. It will not only revitalize the soil, but will restore to the plant much of the nutritional value which has become lost as a result of the prolonged, uninterrupted use of inorganic fertilizers.

Up and down the length and breadth of the United States an abundance of organic waste materials which can be converted into compost is available. The practice of feeding garbage to pigs and polluting streams, rivers and lakes is deplorable from a public health standpoint and must be stopped. The burning of organic matter is tragic.

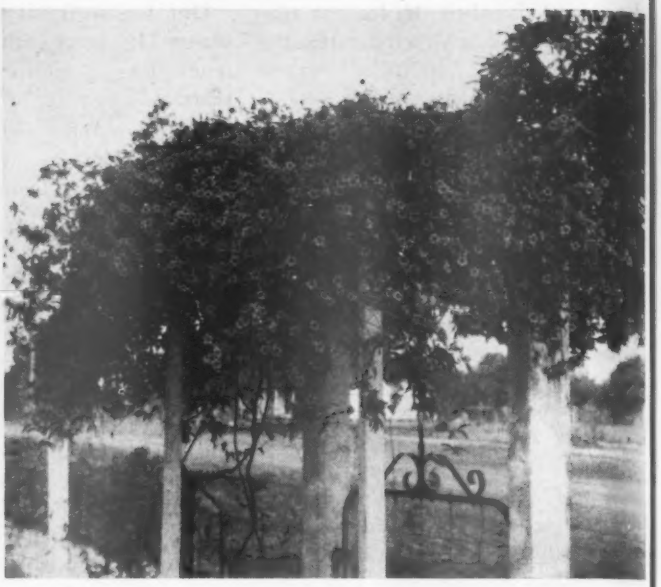
Frazer Compost plants erected near the source of raw materials and the finished product distributed in the immediate vicinity would eliminate hauling and transportation costs — thus keeping operational costs at a minimum and enabling us to offer the product to the user at the lowest possible price. However, our license agreement in no way restricts the sale of Frazer Compost territorially.

The value of Frazer Compost has been proven by thousands of users. This is substantiated by the great number of testimonials available at the offices of our Chicago licensee, Frazer Illinois Compost Corporation, 999 Exchange Ave., Union Stock Yards, Chicago, Ill. — as well as the number of repeat orders from our customers, many of whom have ordered ton, and even carload shipments, after experiencing desirable results from their initial small package purchases.





Clytostoma callistegioides



Gelsemium semperviren

HARDY EVERGREEN VINES

Select vines which can survive the winter in western gardens.

By CHARLOTTE M. HOAK

A WEEK after the recent freeze in Southern California, the heaviest in thirty-six years, I made a quick survey of the damage done to our evergreen vines. The popular semi-tropical and tropical ones hung in limp discolored masses from eaves and trellises. Some of them may come back from the roots, but it will take a long time. Some of the reputed "hardies" were badly nipped.

However, in the course of the afternoon I found twelve hardy evergreen vines which stood up well and came through the frost ordeal with flying colors. You will not find these as handsomely flowered as the gorgeous bignonias, nor as luxuriant as the showy bougainvilleas and *Solandra guttata* with its huge chalices; yet, for dependability of flowers and foliage throughout the year, they are very acceptable in this locality.

Many of these vines come from those monsoon districts of Northern India, China and Japan where they have cold, dry, frosty winters and warm, moist summers. In our watered gardens they do exceedingly well and survive our coldest weather unscathed.

One of the finest of this group is *Trachelospermum jasminoides*, well-known in the Southern States as the Star or Confederate Jasmine. In this section, it is now being used quite extensively for trellises, wall embankments, and as a general ground cover. A summer bloomer, its fragrant white stars stud the clean, leathery, green foliage with myriads of sparkling points. It takes either sun or shade, but does best in an eastern exposure.

That attractive scandant species of camellia, *Camellia Sasanqua*, a fitting companion for *C. japonica* is recommended as a background for shade garden plantings. Its pliant branches are pleached readily against walls and trellises. The shining evergreen leaves and dainty single blossoms resembling Cherokee roses make it an ideal background plant.

The popular Primrose Jasmine, *Jasminum primulinum*, a somewhat rampant vine which is excellent for high trellises and an extensive ground cover for steep embankments is frost-resistant. In mid-winter it usually throws down its curtain of golden light from some high eminence. It loses its supple beauty and becomes an unkempt mass when forced by circumstances to be a drought-resistant. In very cold winters it may

(*Continued on page* 33)

A Welcome Gift — Organic Gardening

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Just fill in the Christmas Gift Forms, sign your name in the gift card at the bottom of the page, tear out the entire page, and send it with your money order or check. That's all there is, and your Christmas buying is over. Use plain paper for additional subscriptions.

SPECIAL XMAS BONUS: A reduced rate on multiple gifts. Take 20% off the price of each additional gift subscription. For example, if you enter three gift subscriptions to ORGANIC GARDENING, the first costs you $3 and the others **only $2.40 each!**

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City ..... Zone ..... State .....
Please send: ☐ **Pay Dirt $3** ☐ **Hunzas $3** ☐ **Organic Front $1** ☐ **Stone Mulching $3**

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Cut out this page and mail to: Organic Gardening, Dept. XD, Emmaus, Pa.

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PAY DIRT

Farming and Gardening with Compost. The best guide to the organic movement. Points the way to proper farming methods, shows how to obtain bigger yields of disease-free, health-giving crops. For the backyard gardener as well as the large-acreage farmer. ***$3.00***

The HEALTHY HUNZAS

The true story of how the health and vigor of a living soil are passed on to crop plants, animals, and finally to its human inhabitants. The Hunzas are a people who return all residues to the soil and from it receive health and happiness that are unequalled anywhere in the world. Illustrated. ***$3.00***

THE ORGANIC FRONT

Answers the question, "Is our health related to the soil?" in terms of the fundamental principles underlying successful farming and gardening. 200 pp., cloth. ***$1.00***

Stone Mulching in the Garden

A new invention in gardening! An authoritative guide to the use of stones and rocks for obtaining greater yields and healthier plants. Illustrated. ***$3.00***

More Christmas gift suggestions on the other side!

Camellia sasanqua

(*Continued from page* 30)

shed some of its leaves, but its clean green stems are always attractive.

There are two other jasmines very much worth while. The first is the little-planted *Jasminum floridum* with its dark green tri-foliate leaves and its rich, golden yellow, fragrant flowers. When the high-climbing *J. gracillimum* hangs its long lithe streamers in desolate strings and the other "warm-house" jasmines, *J. azoricum* and *J. nitidum* are frozen to the ground, this hardy one, also from China, makes a deep green note in the garden, its cymes of golden yellow stars held in abeyance for February warmth to start it on its long period of bloom. It makes a neat background wall for a small garden where you do not want to sacrifice your space to a hedge.

The second is a more familiar one, hailing originally from a similar habitat, *J. grandiflorum*, known by many popular names such as Catalonian, Italian and Spanish jasmine. It is probably the best white-flowered species; and, as it stands 10-12 degrees of frost, it wins a recommendation for hardiness.

Another excellent vine associated with the Jasmine group is the Carolina Yellow Jessamine, *Gelsemium sempervirens*, which bears a profusion of fragrant yellow flowers, in winter and early spring. About to burst into bloom, at the onset of the recent cold spell, it has suffered nothing worse than a delayed blooming period.

Many of our evergreen *Loniceras* come from China, but they are so rank in growth and carry so much dead wood that the average home owner is reluctant to plant them. However, there is that neat compact one so highly recommended by the late Kate Sessions, *Lonicera confusa*. Its creamy white flowers exhale the most entrancing fragrance.

Add to your list of honeysuckles that old time-honored one renowned in poetry and song, *L. Periclymenum belgica*, the woodbine of Shakespeare, commonly called Belgian Honeysuckle. By way of variety it may be grown as a standard instead of on a trellis. One plant perfumes an entire garden.

One of the good 100 per cent Americans is the evergreen or trumpet honey-suckle, *L. sempervirens* (from Connecticut to Florida, west to Nebraska and Texas). It came west with the pioneers and was a great favorite in the gardens of yesterday. There are several fine color forms which are available.

Coming to us from the Australian semi-arid region is a small evergreen vine often overlooked among the showy ones, the Australian Bluebell Creeper, *Sollya heterophylla*. Just now it is perky and untouched by the burning fingers of the recent frosts; and, as it peers out from under the wreckages of frozen vines, you appreciate its green freshness. It stands sun or shade, winter cold or summer drought with amazing equanimity. For covering low wire fences, sloping embankments and draping low walls it has few equals. Being a vigorous and rapid grower under good culture, it needs to be prevented from tangling its slender vining ends.

One outstanding member of the Bignonia group, *Clytostoma callistegioides*, catches our eye, especially when we glimpse it in juxtaposition to a badly frosted *Pittosporum undulatum*. For pergolas, high fences and trellises you have a vine which makes complete coverage rapidly once it gets established. It needs space to display its shining green foliage which forms a perfect background for its myriads of violet tinted flowers in late spring and early summer. It, also, has the advantage of bearing few disfiguring seed pods.

To complete our dozen we add an old time favorite, *Solanum jasminoides*, well-known in pioneer gardens and called potato vine because its blossoms are almost an exact replica of those of the potato. This hardy South American pales before its more pretentious cousins, the dainty blue-flowered, red-berried *S. Seaforthianum* and the large cymed violet-hued *S. Wendlandii*, which once gained for itself the reputation of being the showiest vine in the Los Angeles area when in bloom. Both are badly frosted now, while the inconspicuous modest one is fully evergreen at present, triumphantly disentangling itself from the greedy *Plumbago capensis* which has gone down to the ground. This *Solanum* has never been valued enough for airy, drapery effects which can be created by judicious pruning and training. In mild years it is seldom out of bloom.

Boutrelle

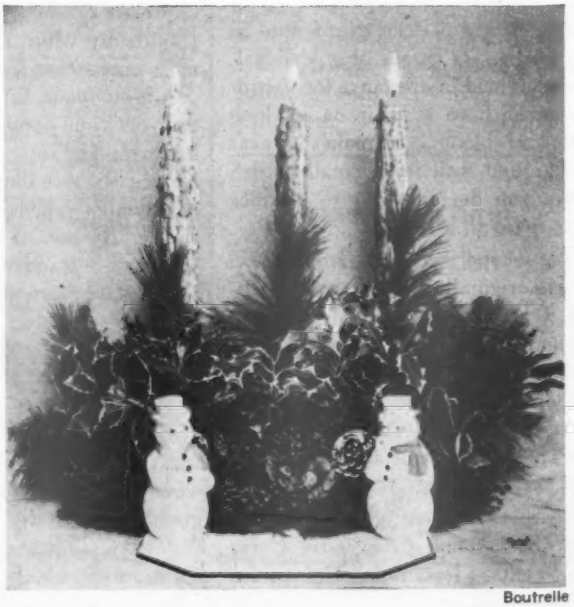
December Decor

By ANN ANDREWS RODALE

MOST of us go all out to decorate our homes for Christmas. This holiday is spent mainly indoors so that our task is appreciated by both children and adults.

The fragrance of fresh pine and spruce with the sound of the crackling proverbial yule log in the fireplace spells a happy holiday.

The famous Hogarth curve is excellent for Christmas arrangements when used with bright red flowers. William Hogarth, an eighteenth century artist, called this curve "The line of beauty and grace." Garden Clubs have used this classification with great success. Materials used in this arrangement are Arborvitae, stocks, geraniums, euonymus, grapes and foliage. Arranged by Mrs. Stuart Du Brenil



Boutrelle

This arrangement with candles can be used on the mantel or the dinner table.

The Christmas arrangement is placed on a mirror with artificial snow and wax snow men. Pine branches rise vertically with the candles to give the arrangement height. White-tipped holly, juniper with berries, and pine cones compose the arrangements. By Mrs. R. A. Boak.

OUR SOIL PROBLEM

We must follow nature's pattern in soil building.

By ERIC EWESON

DEEP concern about our declining soil fertility and the danger of world starvation in a near future is evident on many sides. Recent books on the subject by Fairfield Osborn, William Vogt and J. I. Rodale have focused attention on the subject. The United Nations has discussed the problem. So have numerous other political and economic bodies. Statistics from the U. S. Department of Agriculture to the effect that more than two thirds of our farming area is completely or partly worn out support the view that the situation is extremely grave.

Opinions are sharply divided, however, on the best solution to the problem. One group favors: having more people work the land and fewer living in cities, reducing the number of industries which draw on arable land for raw materials, and replacing farm machinery with animals in order to increase the supply of manure. Along with all this, of course, they advocate more universal use of sound agricultural practices such as crop rotation, terracing, and cover cropping. Some even propose limiting the world's population, as advocated by Malthus some 125 years ago.

Another group, the most numerous one, made up of most of our agricultural experts, agronomists and chemists, contends that chemistry and modern techniques can solve the problem. This group therefore recommends more chemical fertilizers, more farm machinery, better seeds, more effective pest sprays and weed controls and, of course, extensive soil rehabilitation and erosion control. Vegetables grown in chemical solutions are other proposals for increasing our food supply.

A third group disagrees with both of these factions on the proper solution. Its answer to the problem is composting by farmers and gardeners of their vegetable and animal wastes. With this I agree in principle, although I doubt its general practicability under present conditions of high labor costs, rural labor shortages, inadequacy of animal wastes on many farms, etc. My specific proposal is therefore *large-scale industrial manufacture of compost* from the vast abundance of our nation's municipal and industrial waste materials – making rich compost available in quantities never before thought possible.

Importance of Topsoil

Fertile topsoil, by far our most indispensable national resource, is fundamentally a mixture of disintegrated rock in form of sand or clay, organic residue and humus, the latter being a mass of microorganisms and decayed organic matter. In temperate climates, under favorable conditions and with no cropping, such topsoil may accumulate at about one inch in 100 to 300 years.

Mesopotamia, Persia, Greece, Italy and North Africa, sites of ancient civilizations, once enjoyed considerable accumulations of fertile topsoil, but they were eventually exhausted. Continental Europe's soil resources began to show severe deterioration during the 18th century, long before America became its food supplier. In this country, in less than a century, the process of declining soil fertility has even reached the heart of our Middle West, long considered inexhaustible. Actually modern agricultural methods have used up topsoil much faster than those of any ancient civilization.

The significant characteristic of fertile soil is its content of humus, which word should be understood in the restricted sense to indicate only the rich, complex, living mass that comprises end products from the microorganic process of decay—nature's composting process. True humus is not synonymous with organic soil residue, and above all it must not be confused with peat or peat humus, a substance which results from an entirely different process of decomposition, which takes place when the supply of air is cut off, usually by water. The actual content of true humus even in fertile soils is amazingly small; one per cent is adequate for many types of soil, provided that the total amount of organic residue (from which humus will renew itself) is about three to four times that much.

Loss of soil fertility is, primarily, the loss of this humus content. Normally it is caused by over-cropping. The growth of plants consumes humus which must, in turn, be replaced by formation of new humus to prevent gradual exhaustion of the soil's fertility. No amount of chemical fertilizers can add to the humus content or replace it; on the contrary they tend to consume or burn up the humus and to destroy its microorganisms and other soil inhabitants such as earthworms thereby speeding up the process of soil exhaustion. This, of course, is the main reason why we are using up our land so much faster than other nations have before us.

Why is humus so important a component of the soil? Humus has

great moisture absorbing capacity, compensating for droughts and reducing to a minimum the peril of floods; it protects the soil from overheating during the day and overcooling at night; it acts as a soil binder to check erosion; it is essential to maintaining a thriving earthworm population; it contains plant nutrients and billions of soil microbes in every ounce. With the latter as its agents it decomposes and converts organic matter such as fallen leaves, withered plants, animal droppings and even particles of rock into plant food. Some soil bacteria also have the ability to absorb nitrogen from the air to meet the plant's requirements for this important element.

Lately there has been much talk about deficiencies in the soil of so-called "trace" minerals – such as boron, iron, copper, nickel, fluorine, iodine, etc. – and the effect of such deficiencies on crops, domestic animals and our national health. The general belief is that the minerals have been used up by crops and therefore need to be replaced. This is incorrect. The supply of these minerals in the soil is normally more than adequate but they are in non-water soluble combinations of rock origin and cannot be utilized by plants unless humus, microorganisms and other soil inhabitants in sufficient quantities are present to break down and convert these rock materials into the kind of soluble compounds plants can assimilate. Mineral deficiencies are common characteristics of dead or dying soil, not of soil with enough humus.

The Use of Chemicals

Even if we possessed sufficient knowledge and if it were practical to provide chemical fertilizers containing some 20 to 30 elements in the infinitely varying proportions required by plants – instead of only nitrogen, phosphorus and potassium as is now general practice – this would not offer a solution to the soil problem. Forcing upon the plants immediately available food, which they cannot reject but must absorb, in form of water-soluble chemicals constitutes a bypassing of the soil's extremely important functions in relation to plant life, in the same manner that intravenous injections of sugar or protein bypass the digestive system of the human body. Neither can contribute to normal, vigorous life.

Today's agricultural experts are too much concerned with the as yet largely unknown mysteries of plant nutrition. Therefore, their thinking is along the deceptive lines of feeding the plants directly as if they were an isolated manifestation of life, instead of a transient stage in the continuous cycle of life, with no real beginning and no real end. Feed the soil to sustain its incalculable billions of inhabitants, which is comparatively simple, the plants will then as always take care of themselves.

It is true that for a limited time fair-sized crops can be grown in humus-deficient soil by the addition of increasing quantities of chemical fertilizers. The actual length of time during which chemical fertilizers appear to be successful for raising crops depends largely on how long the humus in the soil will last. However, even at best, such crops will be lacking in protein, vitamin and proper mineral content, which has been proved over and over by comparative anaylsis of grains, vegetables, eggs, milk and other products derived from naturally fertile soil and those from chemically fertilized soil. (It is important to realize that excesses in the mineral content of plants are now very common, and often more dangerous than the deficiencies.) Plants grown in humus deficient soil also lack resistance to pests and parasites and have a tendency to lose their powers of reproduction. Disease can be traced from deficient soil, via deficient plants, to deficiency manifestations and declining health in all higher forms of life.

Chemical fertilizers must not be confused with natural rock materials like ground-up limestone, phosphate and potash rocks. They are valuable soil supplements especially for rehabilitation of worn out soil and are not harmful to soil life; moreover, to be utilized by plants they require breakdown by microbic activities.

Agriculture Today

In this light let us now examine some of our modern agricultural practices.

Chemical fertilizers are like shots in the arm to the soil. They greatly accelerate the consumption of humus, but do not replace it. This leads ultimately to the soil's exhaustion and to erosion, floods, and dust-bowl conditions. Intensive agriculture gives high yields but consumes much humus. So it must be balanced with intensive decay – that is, formation of new humus – to prevent loss and gradual exhaustion of soil fertility.

Contour plowing, terracing, crop rotation, cover cropping, sheet composting, mulching and reforestation are sound and essential practices, but limited in their effect. Contour plowing, for example, will reduce erosion and permit soil rehabilitation but will not prevent subsequent exhaustion of the soil. Cover cropping is likewise no panacea and its success depends entirely on the soil's ability to decompose the crop through the presence of humus and soil microorganisms and turn it into more humus. On exhausted soil cover crops will remain undecomposed for long periods.

High yields are always of questionable value when attained at the cost of depleting the soil's content of humus. They represent "mining" of the soil, or spending of our soil capital. If conditions exist that justify such practices temporarily then we should at least realize what we are doing.

Destruction of crops by pests and parasites is nowadays worrying the farmers and gardeners more than anything else; probably because the prospect of soil exhaustion is less apparent, and seldom realized in time. Spraying to check the growth

The Frazer Composting Plant.

of parasites has in a comparatively few years become a standard practice, increasing in intensity year by year as new pests develop and the old ones acquire greater resistance to the sprays. For certain crops as many as ten applications of sprays per season are not unusual, clearly indicating that we are simply fostering tougher and tougher breeds of pests. The final outcome of this battle is at best doubtful, but meantime the higher forms of life are deprived of the protection provided by nature's scavenger forces and as a result suffer from deficient and sometimes even poisoned food, inferior in taste and keeping quality.

One law of nature is that pests and parasites have for their purpose the elimination of deficient plant life – that is, plants which are unfit to reproduce their species and unfit as food for higher forms of life. Only in this manner can the species improve and degeneration be prevented. The normal function of pests is the destruction of deficient plant life, so it may return to the soil for decay and re-start the cycle of life.

Plants grown in fertile soil do not succumb en masse to such destruction. This may appear to be a rash statement, but it is a fact which has been proved conclusively, and which can be proved by anybody who has a few square feet of garden. If it were not so only scant plant life would now survive on the earth. With the abundance of deficient plant life, pests have become the normal if not the dominant factor in agriculture. This development parallels our declining soil fertility and the increasing use of chemical fertilizers.

In similar manner, weeds are often indications of soil deficiencies. Some weeds appear when the soil becomes too acid, others when it is too alkaline, too rich or too poor in potassium, iron, calcium, etc. But the most significant fact about weeds is that if left to their own devices (which of course is not recommended), most of them will in their good time correct the very deficiency which brought them about. Daisies, for instance, thrive in calcium-deficient soil but are comparatively rich in calcium because they have the ability to accumulate this element from higher potencies of dilution than other plants. So, as they die and revert to soil, the calcium deficiency is gradually corrected.

Many deep-rooted "weeds" like Dandelions thrive even in poor, dry, hardpacked soil; their deep root systems penetrate the topsoil for moisture and mineral nutrients in the subsoil, thereby breaking up and after their decay enriching the top soil so that other and more demanding plants can establish themselves. It was the "weed" type of plants – notably mosses and lichens – that prepared the earth for its present green carpet. Deep-rooted "weeds" like Chicory, Cocksfoot, Kidney Vetch and Burnet could play extremely important roles in soil rehabilitation and modern soil management if their possibilities were properly understood, and not as now only utilized by a few exceptional farmers.

Chemical sprays and weed controls might be compared to aspirin: they affect the symptoms but never the cause of the trouble.

(To be continued)

WALTER AND THE BEAN STALK

What compost did to plants in Walter Madson's garden.

By WILLIAM H. EYSTER, Ph.D.

EARTHWORM compost certainly does put a growing urge in vegetables and flowers. The lima beans shown in the picture grew to a height of 35 feet by midsummer when the wind blew so hard against the great leaf expanse that down came the support, bean plants and all. The towering of the bean plant high above the tree and the wires of the power line remind one of Jack and the bean stalk, the bean stalk that grew up into the sky. If the stalk shown here had not been blown down it might also have grown into the sky, and the beans could not have been picked.

The tomato plants grew to a height of 13 feet by midsummer, and set many-fruited clusters of fruits which varied from 12 to 15 inches in circumference. It should be noted also that the fruits are more spherical than flat in shape.

Dahlias responded in the same manner to the earthworm compost. The plants grew to a height of nine feet, and developed flower heads of proportionate size.

After looking over the garden in which these plants were grown, a greenhouse man said to Walter Madson, who grew the plants in his own garden, "Madson, this is not fair, growing things all out of proportion to what they should be." But what the greenhouse man could not see was that the quality of the vegetables was also in proportion to their size.

Large clusters of large tomatoes.

A lima bean plant grown with compost.

Seminar

FLORIDA—CALIFORNIA

By RUTH RODALE

Q. What soil treatments will be most helpful in irrigated districts?

A. If the irrigated soil is excessively sandy, artificial fertilizers are of practically no value as a plant food. Being highly soluble minerals, such as sodium nitrate, the fertilizers will be quickly washed out of the soil by the irrigation water. Adding manure, organic matter, and growing cover crops can provide the humus to hold on to the irrigation water. Large amounts of stable manure are most satisfactory, whether mulched or plowed under.

If irrigation is done on heavy, clayey soils, use organic matter to lighten the texture. More water can then enter without waterlogging the soil. Be careful also of excessive cultivation. The heavy equipment needed will compact the land and lower the infiltration of water. The structure of the soil can be injured eventually reducing crop yield.

Q. What cultural practices shall I follow to build up a very sandy orange grove?

A. The use of cover crops, mulches, and sheet composting procedures are the chief ways to build up organic matter in your sandy soil. A cover crop of legumes, crotolaria, or legumes and grasses, to be plowed under with the addition of manure and ground rock products, is advisable. Mulches of hay, or cover crop residues also may be laid under the trees. With a little ingenuity, other valuable organic materials can be accumulated and used as mulches.

Q. Spanish moss is plentiful here; would it be satisfactory to use as a mulch? Stable manure is scarce and expensive here; would refuse from a fish market be a substitute for manure in sheet composting ?

A. Spanish moss makes a very good material, but you must be sure to add enough nitrogenous material to get proper plant food. Manure, of course, contains certain hormones and bacteria for which there is no substitute in any other form, but if you cannot get it, you should at least try to supply enough nitrogen in other forms such as dried blood or the fish scrap you mention. The fish scrap has objectionable odors as a mulch and should be composted first.

Q. Is it advisable to use ammonium sulphate to acidify a highly alkaline soil?

A. We do not recommend the use of ammonium sulphate under any circumstances for increasing the acidity of your soil. The harm done to soil organisms will cancel out any benefits of lessened alkalinity. Instead, add as much green matter or manure to your soil as you can find. The green matter acts as a neutralizer, reducing high alkalinity. An acid peat is most effective.

Q. We have on our new rancho quite a Eucalyptus grove. Could the leaves and the thin layers of bark be used as a mulch?

A. The leaves and bark of Eucalyptus contain Oil of Eucalyptus which makes it undesirable to use them directly as a mulch. They should be exposed to the weather until most of the oil has disappeared. Then the leaves and bark can be ground up and incorporated as mulching material.

Q. Are seaweed and water hyacinths useful for sheet composting under citrus trees?

A. Both seaweed and water hyacinths are high in essential minerals. Seaweed contains considerable potash, copper and most trace elements. Water hyacinths are the conservers of minerals in streams that are draining our fertility from the land into the sea. They are 93.4 per cent water and 6.6 per cent dry matter. The nitrogen content of the dry matter is two per cent. The ash includes four per cent phosphoric acid, 11.2 per cent potash, 5.6 per cent magnesium, 8.5 per cent calcium and 39 per cent insoluble residue. As you see, these crops of the sea and streams are an important asset on your fertilizer ledger.

Q. Can oil sprays be used on citrus trees?

A. There is no harm in spraying citrus trees with an oil spray. This kills scale and other insects by forming a film over their bodies.

Q. Would like to know your opinion as to the use of tobacco stems, in quantity, on citrus grove land.

A. Tobacco stems or tobacco dust

should not be used in concentrated amounts as a mulch. This organic matter may eliminate insects, but it may also kill off beneficial insects and earthworms that turn the organic matter into humus. (A poison spray, Black leaf 40, is made from tobacco residues.) But if the tobacco materials are mixed with other organic matter in moderation, they may be used as mulches, or in sheet composting without danger.

Q. All the books my husband and I have read pertain to Eastern farming and gardening. We wonder how practicable the organic method is in regions where all the rain falls in winter and there is a prolonged dry season in summer.

A. In regions having abundant but driving winter rains and a long, dry summer, it is absolutely essential to maintain the soil in such physical condition that it will absorb all or most of the rainfall. The water can be held in reserve so that it is readily available to the plants during the rainless growing season. But the water-holding capacity of a soil is increased as the size of soil particles become reduced. Of course, there is very little we can do to change the size of the rock particles in the soil. Compost is capable of holding from 9 to 25 times its volume of water as compared to clay particles which can hold only about one half its volume of water. Soil rich in compost can hold only about one-half its volume ume of water. By sufficiently increasing the organic matter in the soil, the latter will absorb enough water during the rainy season to supply the growing plants during the dry summer.

Q. What causes bananas to split open before they are ripe?

A. The splitting of your bananas before they ripen is an indication that the soil is deficient in some of the nutrient elements which they need. The deficiency might be made up by adding pulverized phosphate rock, potash rock or seaweed. Too much moisture might also be responsible.

Gathering duckweed to fertilize soil.

FLORIDA'S STRICKEN WATERS

Part IV. Farmers' cooperatives should be organized to utilize water hyacinths for farms and orchards.

By HOMER G. SHOCKLEY

THE farmers and fruit growers of Florida whose lands are on and near water hyacinth-infested waters should organize themselves into convenient-sized cooperatives for the purpose of gathering and using water hyacinths for mulching and composting purposes. Each cooperative district should build, or otherwise acquire, a self-propelled hopper barge with a revolving set of grab hooks at the forward end, which would rapidly gather the floating hyacinths and discharge them into a grinding or shredding machine that would cut them into small pieces to be gathered in the hopper section of the craft. When filled, the barge would then proceed to its prepared landing where the macerated hyacinths, in a semi-liquid state, could be pumped into large bins preparatory to being mixed for composting or being transported directly to the land for mulching.

The State is so vitally concerned in keeping the navigable water channels open that it could well afford even to supply the barges and equipment for gathering the hyacinths for the use of the proposed cooperative districts. Such action would give the whole project a tremendous boost.

Each cooperative should build a serviceable composting plant where they could bring animal manures, garbage, other vegetable matter, and sewage sludge (where available) to combine with the water hyacinths for compost. The character and amount of these materials available would vary with the locations. The districts within striking distance of cities and sizeable towns could arrange for considerable quantities of garbage and sludge. Other places would be able to get lesser quantities of garbage and perhaps no sludge. However, the districts farther away from large communities would be more likely to have larger amounts of animal and poultry manures.

In this matter of the water hyacinths, the appropriate move would be for the State to take the initiative and help in every way possible to organize the various cooperative districts with favorable laws for their formation, and lend all possible technical aid to design the necessary plants and equipment. However, the State could well subsidize the farmers to gather only from the channel areas, serving the double purpose of aiding navigation and helping the farmers to finance their operation. The size and type of composting plant in each instance would have to be determined on the basis of available materials and economic considerations.

DECEMBER GARDEN CALENDAR

By WILLIAM H. EYSTER, Ph.D.

IN GENERAL

- Finish raking and using your autumnal leaves.
- Clean off vegetable garden and place diseased plant parts in the compost heap.
- Protect your garden soil with a plant mulch, or winter cover crop.
- Mulch shrubs and trees with shredded leaves.
- Mulch acid-loving plants with sawdust and pine needles.
- Prune evergreens that need pruning, and water well.
- Finish planting lilies and other spring-flowering bulbous plants.
- Finish storing winter vegetables, fruits and seeds.
- Put a protective mulch over vegetables which remain in the soil over winter.
- Winterize your ornamental plants.

The North and East

Flower Garden: — So long as the ground is not frozen, bulbs of lilies and the native species of tulips may still be planted. If your lily bulbs are late in arriving, cover the place where they are to be planted with a deep mulch which will prevent the ground from freezing well into the winter. Cut off all dead plant tops of chrysanthemum, foxglove, hollyhock, and other herbaceous plants and use them for mulching, sheet composting or heap composting. Enclose your tree peonies and tree roses with wire netting and cover them with leaves for the winter. Tree roses and climbing roses may be layered underground for the winter. Prepare your excess flower seeds, collected from your own garden during summer and autumn, for Christmas gifts by putting them up in neat and colorful seed packets. Your friends will appreciate choice organically-grown seeds more than almost anything else you might give to them. Such seeds grow into plants which represent a remembrance that lasts through the following year.

Vegetable Garden: — Sanitation is just about the most effective measure that can be taken against diseases and insect pests. Plant disease-producing fungi may spend the winter on crop residues, while insects may find shelter under such residues. Therefore it is advisable to clean off the crop residues and mulch the vegetable garden with finely shredded autumnal leaves or the residues from the flower garden. Also the residues from the vegetable garden may be shredded and used for mulching the flower garden. Or the vegetable garden may be seeded in winter rye or hairy vetch as a winter cover crop. Far more attractive is a neat, orderly garden seeded with a cover crop or covered with a finely shredded mulch evenly distributed, than one having half frozen vegetables of different kinds lying about in a disorderly fashion. Many of the garden insects hibernate in these dead vegetable remains. Why allow this to happen in your garden?

Shrubs and Trees: — Shrubs and trees have become dormant for the winter season. Those which drop their leaves in autumn are called deciduous, while those which hold their leaves for two or more years are called evergreens. Two important measures to be taken in December are mulching and pruning. All shrubs and trees should be mulched, and those that should be pruned at this time include climbing rose, honeysuckle, lilac, and mock orange. Tender shrubs as boxwoods, daphne, and southern species planted in northern gardens should be protected as indicated in another article in this issue. Evergreens that need pruning (most of them should never be pruned at all) should be trimmed about two weeks before Christmas, and the trimmings should be saved for Christmas decorations. These trimmings should be kept in a cool, dark place and sprinkled occasionally with water. After being conditioned in this way, the leaves and fruits will remain on the evergreen branches longer than if they are taken directly from the tree at Christmas time.

Fruit trees should be protected from mice and other rodents by removing all plant materials from the space around the trunk and replacing them with gravel or sharp cinders. Also around the trunk should be placed a cylinder of wire netting to prevent mice and rabbits from chewing the bark from the tree trunk. The old canes of blackberries and raspberries should be cut out if this has not already been done. A surface mulch of shredded plant

materials is beneficial to the berries. Newly planted trees should be anchored against winter winds. After the ground is frozen lightly, all trees will be benefited by being mulched. Conifers and such broad-leaved evergreens as azaleas and rhododendrons should be watered freely and mulched just before the ground freezes.

The Rockies

Shrubs and Trees: — Water well, especially any newly-planted items; all of them ought to go into the period of severe cold with plenty of moisture having been absorbed by their root systems. If field mice and rabbits have done any damage in your neighborhood, put wire protectors around all young fruit trees. Keep compost and leaf mulches away from the base of these trees to obviate tunneling. Your lilacs will behave beautifully next spring if you now prune away suckers and dead branches and work lots of compost and a little lime into the basal soil.

Indoor Garden: — Start some of your bulbs now, putting them on a shelf in the storage cellar or some other cool dark place. Keep them there, with the dishes full of water, until plenty of roots are climbing around between the pebbles and stones and the shoots have gotten a good start. When taken upstairs, hold the bulbs back with coolness and an avoidance of sunlight until the flower buds form. Neglect of these principles may cause your Paper Whites to shoot sky high and then tumble over, thus wasting the strength that should have been converted into fragrance and beauty.

Saturday afternoons that are dreary outdoors are just the time to catch up on your garden reading. Remember that the shrewdest gardener is always a student eager to pick up new pointers. Besides reading your garden guides and ORGANIC GARDENING magazines, there's that grand parlor game to play, trying with pencil and paper to work out a system to beat all of next summer's enemies, whether biologic or atmospheric. While last summer's campaign is still fresh in your mind, map out your horticultural strategy and tactics for next year, seeking to profit by this year's failures and successes.

What about Christmas? Your garden, and Mother Nature's, surely can offer festive decorations: a string of your gourds enamelled blood red and other appropriate colors, a Christmas wreath for the front door made from Douglas Fir boughs, cones, and a wide scarlet ribbon, neatly knotted, and other such ornaments. Then there are the gifts from your garden and orchard: cuttings, seeds, jams and jellies, pickles and relishes, wines. Packaged to indicate Christmas friendliness and cheerfulness, such gifts will have a special charm.

The South

Flower Garden: — Rose bushes may be planted from now until the end of March. Flower seeds to plant are: ageratum, alyssum, African daisy, aster, bachelor's button, balsam, blue lace flower, calendula, calliopsis, candytuft, carnation, Chinese forget-me-not, Shasta daisy, Chinese pinks, gaillardia, strawflower, hollyhock, larkspur, lupine (last of this season), nasturtium, pansy, phlox, poppy, Queen Anne's lace, salvia, scabiosa, snapdragon, sweet pea, statice, verbena, vinca. To make a really impressive corner of the flower garden, give sweet peas a tall trellis to climb upon and fertilize the plants generously.

Vegetable Garden: — December plantings include beet, broccoli, Brussels sprouts, cabbage, Chinese cabbage, carrot, cauliflower, celery, collard, eggplant, endive, kale, kohlrabi, leek, lettuce, mustard, onion seed and sets, parsley, parsnip, peas, pepper, potato radish, romaine, rutabaga, spinach, swiss chard, tomato, turnip. In case your soil varies from alkaline to acid, it may be worth while to humor such crops as potatoes, sweet potatoes, parsley and strawberries, by giving them soil that is somewhat on the acid side. Blueberries like a strongly acid soil, but they are a difficult crop to raise in the central part of Florida, where they are inclined to run to branches and new growth rather than fruit. In northern Florida they do well.

Trees and Shrubs: — An extremely productive fruit tree is the guava. It is easily and quickly grown. It bears during the winter and spring and sometimes into July. For eating out of hand the little strawberry guava is best. The larger variety is useful for making the popular guava jelly. It makes a fairly good sized tree when full grown, and does well on either sand or muck soil, or a mixture of the two.

The Southwest

In December the busy gardener in the Southwest can take a rest from the more strenuous garden activities and shop around for the holidays and do some constructive planning for the active work which will commence early in January. Your early planted material should be mulched and watered carefully until copious winter rains occur. Composting should be continued throughout the winter season. Be sure to utilize all your waste clean-up material either for bin composting or sheet composting. As they are clearing out old lawn, utilize the Bermuda rakings. Our soils after the long hot summer season are crying for humus, it is a better stimulus than a shot of commercials for jaded soils.

Flowers: — You can still continue planting hardy perennials and winter annuals from containers and plant bands. Those who did not get their sweet peas in during August and September can make another sowing now. Use the reliable Cuthburtsons which are particularly suited to our conditions. If the birds raided your earlier plantings you can obtain them in plant bands and set them immediately into the rows where they are to bloom. Seasonable bulbs can still be planted as long as good firm bulbs are obtainable. Bargains are the most expensive for they are either undersized, or dry and shrunken and soft and pulpy.

A late succession of potted bulbs may be put in the first week in December. Many fine daffodils and tulips are offered at reduced rates. The species tulips make permanent planting. *Tulip Clusiana, T. Kaufmanniana,* and *F. Forestiana* (Red Emperor) are particularly fine. The giant hybrid amaryllis coming from the California and Florida hybridizers make the most showy and satisfactory pot plants for winter and early spring. For shaded locations under oak trees try the florist's Cyclamen and the Belgian hybrid Clinias. Hardy ferns, which we do not make enough of, can be set out in shady location. Use plenty of compost and leafmold in preparing the planting areas, and select your ferns according to their height. Large pots of cinerarias and primulas can be transferred to the spaces left bare by the removal of summer plantings.

Trees and Shrubs: — As soon as the leaves are off the deciduous trees and shrubs, prune and shape up those which have not been cared for earlier in the season. Avoid "Japanese bobs." Consult R. Stanford Martin's excellent pruning book written especially for Southwestern gardens. Spend much time in preparing the holes for planting of the bare root roses and deciduous material which will be available during the first weeks of January. Visit local nurseries, and place orders early so as to get the best that is available. For immediate results potted and balled deciduous flowering trees do better than bare root stock. Camellias may be planted and transplanted now along with azaleas for late bloom. As you are shopping around select living Christmas gifts for your garden friends. Put quality into plants not into their perishable holiday wrappings. Such material as camellias, berried shrubs, flowering quinces, Meyer lemons and Chinese holly are good choices. The popular redwood tubs furnish all the packaging necessary. Encourage the planting of living Christmas trees — Swason cypress, Incense cedar, and Abies pinsapo are among the best for this purpose. They will live in containers for many seasons, and can eventually be planted out in your own garden, or presented to a park.

Vegetables: — December is not a good month for planting seeds in open rows or for the quick growing winter vegetables. It is about the height of our dormant season here in the Southwest. You cannot always rely on calendars of the commercial catalogs. Prepare rows for asparagus, artichokes and rhubarb, and set out as soon as they are available. Artichoke and rhubarb make handsome ornamentals. Put in cover crops on all unused ground to prevent erosion, to be spaded in in early spring. Plant onions (seedlings and sets). Windsor beans, Chinese edible pod peas, and Telephone garden peas may still be planted. Use the evergreen oriental garlic in your bulb-bed or rock garden. Divide your dormant chives and use them as edgings. Set out your rooted perennial garden herbs. Use trailing rosemary on steep embankments. Where you have good light soil in the full seed, radishes, Southern curled mustard, Chinese mustard and chard can be planted.

A REMARKABLE PEACH TREE

A tree that really grew in Brooklyn.

By HENRY B. TIBBITS

OVER 37 years ago when I first moved to Flatbush, Brooklyn, I planted a peach pit in my small back yard which in a few years grew into a goodly fruit-bearing tree. This tree bore each year and produced each year before World War I two to three bushels of fine large freestone tasty peaches, most of which were the size and color of fancy peaches that one sees on fruit stands.

When about thirty years old it had grown so large that it overhung into my neighbor's yard, and interfered with their clothesline; this made it necessary to trim it severely leaving only two main branches, which still bore good fruit and always ripened after Labor Day.

However, last year after a heavy rain and wind storm during the night, one of the largest branches (which was loaded with over eighty, semi-ripe peaches) parted from the trunk, so I had to cut it off. As this left an unsightly tree, I decided to take it down, which I did by sawing off the remaining branch and afterwards by chopping the trunk off at ground level. After this, I proceeded to dig around the roots, but although I went down two or three feet, I was unable to reach the main roots. So I put a rope around the stump and pulled it out.

This 37-year-old tree measured 24 inches in diameter at the ground level. Each branch which started 30 inches above the ground, measured 18 and 22 inches in diameter respectively; each branch being approximately seven feet long.

Now the remarkable thing about this tree was not only its great unheard of longevity and bearing age for a peach tree, but the fact that it never was sprayed or fertilized and never had a bug or borer of any kind. The only solution I have for the prodigious growth and productivity is that my wife for many years always disposed of any greasy water (from cooking ham or corn beef) by pouring same around this tree.

MISCELLANY

By J. I. RODALE

Mashed Potatoes and Compost

I RECENTLY had occasion to study the question of vitamins in potatoes and suddenly realized how close the theory came to the study of the aerobic method of composting. According to medical records, when food is cut, and exposed to the air, the resulting oxidation causes losses of vitamins. In the case of a potato, therefore, it is best to eat it without cutting it, that is, in the form of a baked whole potato. The minute you cut it into slices as in french fried potatoes, the exposure of the various cut surfaces to the air causes a penetration of oxygen and an oxidation of valuable nutrient elements such as vitamins. Mashed potatoes, therefore, would be the worst offender. In that case there are so many exposed surfaces that at least half of the vitamin C is lost.

In the case of making compost it is the same thing. If you compost your material in such a manner that you allow air to easily get in, and at the same time if you pile the material in such a way that a high heating results which is an indication of extreme oxidation then the losses of nutrients are very great. And bear in mind that compost contains vitamins. This is a known fact and oxidation causes terrific losses in them whether they are in mashed potatoes or in wrong composting. In mulching, I admit that the organic matter is exposed to the air but the decomposition is a cold one with far less oxidation than when it is in an aerobic compost heap. If you have the facilities to decompose organic matter without permitting air to get in you are to that extent conserving nutrients. A good plan is to dig your organic matter into the soil and then allow a sufficient period to elapse to make sure the material completely decomposes before you plant anything. Even under this plan it is also good to apply extra mulches when your crop is growing. Many plants benefit from this practice.

Wrong Fertilizers

Here is an interesting letter which appeared in the Chicago *Daily News* of September 27, 1950:

Lays Poor Flavor of Potatoes To Use of Wrong Fertilizers

In reply to the Boston woman who complained in a letter about the poor flavor of potatoes and thought that the situation could be remedied by having potato tasters, who graded potatoes for flavor instead of appearance, may I suggest that the remedy lies in persuading the growers to go back to nature's way of replenishing the soil by the use of organic fertilizers. Potatoes such as these are the result of having been grown in chemically fertilized soil which produces large, handsome fruits and vegetables but with poor flavor and low vitamin content.

To register another complaint in recent years the fruit on the market has been picked so green as to be inedible and cannot ripen before it rots or shrivels up. Upon asking a fruit dealer about this I was informed that since the growers have invested considerable sums of money in their crops they cannot afford to have any spoilage. This seems like a feeble excuse, for we used to have edible fruits and growers had their money tied up in their crops then, too. Besides, we now have better refrigeration and faster transportation.

Nutritionists tell us we should eat plenty of fresh fruits and vegetables in order to have an abundance of vitamins and mineral salts in the diet but the stuff we city folks are offered is not fit to eat. With this, together with the processed foods the housewife is supposed to feed her family healthful meals. No wonder three out of five young men are rejected by the draft board, and that degenerative diseases are increasing. We have here a basic problem and not one that can be solved by potato tasters.

Mrs. America is the guardian of our national health and should be educated to know that strong bodies and sound minds cannot be built and maintained with chemically grown and chemically processed foods. If she would refuse to accept such foods, the producers and processors would soon change their methods and we'd no longer be called a nation of "One Hundred Million Guinea Pigs."

"ORGANIC GARDENER"

You can do a great service to your country and to the organic movement by trying to get letters published in your favorite newspaper. If you have had any experience with the growing of things by the organic method, let your fellowman know about it. Our opponents are attacking us viciously in the press, taking advantage of their positions in scientific institutions, without any personal experience with the organic method. When you see such an article in your newspaper write the editor your side of it. If possible please save a copy of the clipping for our archives.

Boy Scouts and Mattresses

In a boy scout jamboree recently held at Valley Forge, Pennsylvania, where 47,000 scouts took part and President Truman addressed them, they encamped for about ten days. Each boy brought a sack which the jamboree organization filled with straw which was used as a bed. At the end of the camp period each boy brought his sack to a certain place and the straw was ejected so that he could take his sack back home clean. I wonder what happened to the 47,000 sack-fulls of straw?

The Organic Method in Novels

I recently mentioned a novel called *The Old Oaken Bucket* in which one of the characters was an organic

gardener and the theme was prominently featured in the book. I have just discovered another novel called *Flannigan's Folly* (Publisher: Whittlesy House) in which one of the characters is shown spending a whole afternoon going through copies of *Organic Gardening*. This book is by George Milburn, author of the best-seller called *Catalogue*. Incidentally George has just joined the staff of our *Organic Farmer* which is growing by leaps and bounds. He formerly operated a 250 acre farm in Missouri. I hope that some day not in the far distant future he will give some thought to writing a novel whose entire theme will be the organic farming and gardening revolution. Such a novel might have the same effect in agriculture as Sinclair Lewis' *Jungle* had on the meat packing industry. If people will not listen to fact perhaps they will listen to fiction, like the agricultural professors are giving us.

Sawdust as Mulch

Here is a letter from A. I. Mackay, author of *Farming and Gardening in the Bible* that is coming off our press possibly at the same time that this issue appears. It gives some negative information about mulching.

Dear Mr. Rodale:

The enclosed clipping from our local paper may interest you.

I used sawdust last year on our strawberries and raspberries, principally as a weed deterrent. The raspberries thrived but the strawberries were a failure and wilted; they were everbearing. The sawdust I used was mostly fir with a small amount of cedar mixed, and possibly the turpentine which the article speaks of as inherent in fir damaged the strawberries. I also found watering very difficult as it didn't penetrate but flowed off; the oily turpentine in the sawdust would account for this.

The biggest and I would say the most prosperous berry farm on Vancouver Island uses tons of sawdust, and they grow lovely looking fruit but it hasn't got a great deal of flavor. They irrigate constantly so perhaps that detracts from the flavor.

The Old Romans and Compost

Here is a suggestion from one of our readers which is worth following:

Sir:

Organic gardeners should find the following of interest, which shows that the early Romans had a knowledge of the value of composts which we might well follow today. From *Roman Farm Management* the treatises of Cato and Varro, translated by Fairfax Harrison we find Cato advising that manure be composted: "Plan to have a big compost heap and take the best care of the manure. When it is hauled out see that it is well rotted and spread. You can make manure of litter, lupine straw, chaff, bean stalks, husks and leaves of ilex and of oak."

Harrison also notes what Columella says about the compost heap: " . . . . He goes on to lay down rules about the compost heap which should be written in gold in every farm house." I would recommend that organic gardeners study the Roman treatises on agricultural practices for much sound advice on gardening.

Millard Klein,
Alameda, Calif.

Here is an item sent in by A. Klein of Brooklyn, N. Y., which also is on the subject of olden time agriculture:

The Greek method is unique and is fully described by Xenophon, the Greek historian who lived between 435 and 355 B. C., in a discourse entitled *The Science of Good Husbandry* or *The Economics of Xenophon*, from which the following is quoted:

"We all know that manuring the ground is necessary; but yet some are negligent, and never employ themselves about it, though it may as well be done by turning of cattle into it, as by other means. Some farmers use all their industry to *gather together all the sorts of manures they can find;* and others, though they might as well enrich their ground by the same means, yet never set their minds about it. The rain falls in hollow places; and remains there to the injury of the ground; and where this happens it shows the carelessness of the farmer; the weeds which rise on this occasion are witnesses of his negligence; for the diligent farmer always takes care to lay his ground in good order, and to clear it of weeds; and the very weeds he pulls up reward him for that work; for if he cast these weeds into a pit of water, and let them rot there, they will produce as good manure as dung itself. For there are no herbs or plants which will rot by lying in water, that will not make good manure for land; nor is there any sort of earth which will not make very rich manure, by being laid a due time in a standing water, till it is fully impregnated with the virtue of the water. We may yet remark further, that if the ground be too wet to sow upon, or too surly or sour to plant in, we may drain it by ditches or thorows; and if the ground be stiff and sour, mix it with such things as are light and dry, or of a contrary nature to the soil. We find some husbandmen have regard to this, and some have no thought of it, and throw away those things which might prove to their profit."

It would be interesting if other readers would dig in old books at their library and send in similar items for this department. Your librarian I am sure will be glad to direct you.

Nine New Diseases

Here is an item from the *Science News Letter* of August 19, 1949, which shows what might be expected from now on in agriculture:

"Nine new plant diseases popped up to plague the U. S. farmer in 1949, the Department of Agriculture reported.

"In Kentucky wheat fields, a blight known as *Cladosporium herbarum* appeared. It has caused seri-

ous losses in Europe. A new leaf blight caused complete infection of three fields of broomcorn in Illinois. Sugar beet mosaic, a virus disease, attacked California clover, and a new mold appeared in clover in Oregon and Washington.

"There were 19 instances of plant diseases popping up in states where they had not been found before. In many states, 1949's hot dry weather brought greater than normal losses from plant disease, the department said."

Nine new diseases in only one year! This fits in with part four of my answer to Professor Koon in this issue. I am absolutely sure that unless there is a right-about-face in our attitude towards chemical fertilizers and poison sprays the situation will become progressively worse until two things will happen. The farmer will be unable to make a living, continually combatting disease. Secondly we will reach a point where the food will be so diseased that it will not be fit to be eaten. Anyone with common sense can measure such an obvious trend and see that it is getting worse, not better.

Walls

The September 10, 1950 issue of the *Courier-Journal* of Louisville, Kentucky, carries a long feature article regarding a flood-control measure that is being taken in that section of the country which will cost the tax-payers $27,000,000. It will take from two to three years to accomplish and will consist of a system of levees, walls, pumps and closures. Unsightly walls will be reared up along the river and even in certain sections of the town where there are parks, to hold back Old Man River. How unnecessary this fabulous expenditure is! It is made necessary because of chemical fertilizer farming, which hardens the land and causes the rains to run off instead of being retained in the soil. Louisville is surrounded by farms that are causing all the trouble. Instead of seeing to it that a lot of organic matter is put on their land each year to act as a blotter to absorb rains, the untaught farmer is encouraged to use chemical fertilizers which harden the soil and present an impervious barrier to the rains which run rampage into the rivers. On our farm because of correct practices we do not give up a thimbleful of rain water to ditches or public highways. It is all drunk in by our soil. What a comfortable feeling we have when we see the rains doing that and how nicely it reflects itself in increased crop yields.

The public is now paying for the stupid and lazy practices of the farmer, aided and abetted by the agricultural station scientists. And worse is to come. Do you think we can defy nature by building a wall? That is merely temporary. It is only a palliative. It covers up the fact that the rain-water along with the precious topsoil of the farmer's land is made by the wall to go out and waste itself in the sea — precious gold to be lost forever. The stupidity of walls has been indicated time and again in history. Witness the Maginot Line which the Germans overran with impunity. Then there was the wall built by the Babylonians about twenty-four hundred years ago, a little after the time of Nebuchadnezzar. There was a huge double wall protecting the city of Babylon but the king feared that the Persians might come into the city through the Euphrates River which cut right into the heart of the city, so he built a high wall on each side of the river bank and then set back and said, "Now try and conquer us." But the wily Persian, Darius, bided his time. He brought up his army and waited until the occurrence of a certain festival when he knew that the Babylonians from the king on down would become drunk in riotous celebrating. It happened as he had figured and the Persians were able to enter the city at a weak point. From then on the Persians were in control of Babylonia.

The citizens of Louisville who will sit smugly behind their wall like Babylonians and who will not care what the outlying farmers do to the soil, which is the heritage of all of us will be living in a fool's paradise. The wall will not save the soil. The wall will not mask over the fact that a farm bereft of its topsoil will produce inferior food which will be brought in through that wall into the city. The enemy will eventually enter through the wall to destroy its sinful inhabitants who worship at the idol of Mammon, who care not what happens to the farm-land, so long as they can continue to play bridge and Canasta. This is not an age of walls.

The Soil and Health Foundation

The Soil and Health Foundation has been organized and incorporated in the Courts of the State of Pennsylvania for the following general purposes:

(a) To promote, foster and encourage the use of humus and other organic matter in order to maintain and improve soil fertility, to prevent soil erosion, and to improve the health of man.

(b) To conduct, engage in, foster and encourage scientific research and study and teaching, training, informing and educating the public on and concerning the soil, foods and health of man—and their relation to each other.

(c) To study the effects of organic and artificial fertilizers on soil, plants, animals and man.

(d) In order to accomplish the foregoing purposes to establish, use, maintain and operate farms, schools, laboratories, experimental stations, publishing houses and all other appropriate agencies, means and instruments.

Through its publications, the Foundation will publicize the results of its investigations and endeavor to educate farmers, gardeners, and the public in general in cultural practices which will insure the better conservation of our soils and the public health.

All who make contributions to this Foundation become members, regardless of the amount given. A contribution continues the membership for a year. Will all members who have not done so, send their contributions for another year to the Secretary, Soil and Health Foundation, Emmaus, Pennsylvania.

HOW ABOUT AN ELM

Elms are beautiful and practical shade trees.

By RUTH RODALE

THIS article begins a series on the subject of shade trees that are desirable for the gardener to plant on his lawn, in his back yard, or wherever his landscaping urge should dictate.

One cannot think lightly about buying a tree. It is not like dropping in a few seeds for a flower border. It is really an investment for future comfort and soil protection. So we must consider the special qualities of a number of trees. Will a certain type grow fast enough to fill in an ugly bare spot? Will a favorite species ruin a much prized lawn? Will this one be beautiful in wintertime? At its prime, is that tree too large for a two-by-four back yard?

Let's consider buying an elm tree this month. You won't have much trouble recognizing an elm tree once you have learned a simple trick. All elm leaves, no matter what variety, are lopsided at the stem end. The more advanced botanist will notice strong ribs or veins branching out from the main rib that runs down the middle of the leaf. Elm leaves, also, on the whole are rather hairy and rough. Just compare one with the smooth Norway Maple leaf.

Many people would not care to plant an elm tree on their front lawn. Many of its roots are close to the surface and actively compete with grass roots for moisture and minerals. The tree inevitably wins. The owner will find a straw-colored mat of grass encircling the tree up to the drip line (outer tips of branches). In this case he can forego the beauty of a perfect lawn but make it up many times by using a leaf mulch to feed the tree. Mulching is especially adapted to a type of tree that sends roots close to the surface, since it can prevent drought during hot summer spells.

Photo by U. S. Forest Service

Leaves and fruits of Elm.

The American Elm comes immediately to mind when we think of elms. It is the most aristocratic of the lot, growing extremely tall and graceful. I have heard the elegant shape of the American Elm compared to that of an old-fashioned wine glass. It is a most adaptable tree, easily transplanted and suitable to almost any regions of the United States except dry, sandy locations. Moist, well-drained soils are best. The American Elm cannot readily stand alkali and needs plenty of irrigation to succeed. Let me name a few less-known varieties that can be successfully used by landscape-minded gardeners.

A Stocky Elm

The English Elm is a more compact tree than the American Elm. It is just as hardy and can be grown in the same types of soil. The leaves will stay green longer in the fall than the American Elm.

A Good Southern Tree

The Wahoo or winged Elm, one of the smallest of the elms, can be grown only in the South. It does very well south of Virginia and west to Arkansas and Texas. "Petite" can be used to describe its oblong-headed growth. Use on upland soil near streams and lakes.

A Fast-Growing Tree

The red-barked Slippery Elm is suited to most eastern regions.

An Elm Tree for the North

The Cork Elm has not the elegance of the American Elm, being a large, stiff-looking tree, but it can be planted as far north as Quebec. Watch for corky ridges on most of its branches.

A Weeping Elm

Charming in spring is the Scotch or Wych Elm. It produces large rosettes of flowers that can almost be mistaken for leaves. The variety of Camperdown Elm will form a natural arbor when mature.

The Drought Tree

As a last resort, try the Siberian Elm, which can survive under almost any abuse of soil or climate. While resistant to the Dutch Elm Disease and Elm Phloem Necrosis, it suffers from the cotton root rot. For best results, train the tree carefully by pruning.

After you have planted a variety of elm suited to your area, your work is by no means done. Check on the acidity of the soil and bring it to a pH of 6.5 to 7.5 if possible. Give your tree a heavy soaking of water several hours a week during the summer, rather than light sprinklings often. You may want to read up on tree pruning or consult a local expert.

The organic gardener can fertilize his trees in several ways.

1. Mulching with leaves or sawdust is helpful if grass under the tree is not important. If acid materials are used, correct the pH to about neutral. Insert ground rock fertilizers into mulch.

2. Work organic matter into the soil. Heavy applications of well-rotted manure over the root area of the tree should be turned under with a pitchfork. This method is not practical with elms because the roots, which penetrate close to the surface, are often injured.

3. For the lawn-conscious gardener the punch method can be used. With a crowbar, bore holes about eighteen inches apart in a circle five or six feet from the drip line. Place organic matter, phosphate rock, and potash rock in the holes and fill in. It is important not to punch the holes too close to the trunk. Fertilizers can also be added under the grass by gently pulling back small areas of sod.

4. Still another method is to pour drainage water from closed pits or garbage pits under the trees.

The dread Dutch Elm Disease, a product of neglected care of the elms, is caused by a fungus imported from Holland, causing a wilting or yellowing of the leaves. In severe cases trees suddenly wilt and die without excessive yellowing of leaves.

Photo by U. S. Forest Service

American Elm

The fungus mycelium gets into the water passages so that supply from the roots is cut off.

The organic method is a strong point in eliminating the Dutch Elm Disease. A healthy tree can usually resist attacks from all kinds of parasites. From the habits of the fungus, we can see other ways as well to fight it. Since it is carried by the Elm Bark beetle, it is best to look to him first. Prune away all sick branches which might be breeding places for the beetles. Be careful of all wounds, because the Dutch Elm fungus can enter only where the bark has already been broken. Lastly, watch for news of elm varieties resistant to the Dutch Elm Disease.

An even more deadly disease is the virus, Elm Phloem Necrosis. No trees ever recover when once infected. It also is spread by an insect, the leaf-hopper, and similar advice is given for both prevention and control. In addition, try planting varieties other than the American Elm or the Wahoo Elm. Another suggestion is the new strain of American Elm noted in the July, 1950, issue of *Organic Gardening*, page 16.

Research in the Organic Method

By RUTH RODALE

Are Trees Injured by Natural Gas?

Complaints are often heard that escaping gas, percolating through the soil from broken mains, will stunt growth of trees. In cooperation with the Michigan Consolidated Gas Company of Detroit, Michigan, Felix Gustafson performed experiments for five years to test the effects of natural gas on growing trees. By planting small elms in wooden tubs into which a concentration of 3.5 degrees natural gas was pumped, the influence of the gas could be watched.

Inevitably the experimental trees had thinner root systems than the control trees not treated with natural gas. It was also noticed that the roots of the trees treated with the gas were darker and had fewer fine root hairs. The dark roots were found to have been killed by the gas concentration. On the dark roots the bark could be easily separated from the wood, but on the lighter brown roots, the bark did not separate readily from the wood. Even with this injury to the roots, the leaf and stem growth were apparently not harmed. During drought conditions, the gas-treated trees responded nearly as well as the control trees. Perhaps over a longer period of time, however, the vigor of the trees would begin to decline as the root system is gradually killed off.

Add Nitrogen with the Water Hyacinth

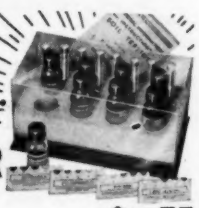
That despised weed of the south, the water hyacinth, has proved its worth. It can be added to the soil in large quantities without causing any nitrogen deficiencies, according to A. Karim (*Soil Science*, July to December, 1948). When the water hyacinth decays, nitrogen in the form of ammonia is released, which is eventually converted to the nitrate form. So if you can find a source of water hyacinth, by all means use it as a fertilizer. But because of its high nitrogen content, the weed must be protected from nitrogen loss. If using in a mulch, try to put other organic matter on top of it.

The Taste Test

Canned peaches that had been sprayed with benzene hexachloride showed an off-flavor in almost every variety tested at the Massachusetts Experiment Station in 1949. But peaches that were frozen or eaten fresh did not taste of the chemical. Of course the same amounts of benzene hexachloride are absorbed into the fruit, regardless of the method of preparation. Cooking, then, merely seems to accentuate the taste of a chemical that is already present even when the peaches are frozen or eaten fresh. The off-flavor noticed in canned peaches has caused many of the producers to do away with the spray. But is it really logical to use the taste test to judge if the spray content is too high?

Enemies of the Elms

The fly isn't the only insect that can become DDT-resistant. Look to the beetles which carry the Dutch Elm disease fungi, says Dr. Stanley W. Bromley of the Bartlett Tree Research Laboratories. While many of the beetles are killed, some strains that can withstand the poison will survive. This year more beetles than ever before have lived in spite of the heavy DDT treatment around Stamford, Connecticut. Spraying is especially done on the bark of ailing elms, where mother beetles are most likely to lay their eggs. Every year more of the resistant young larvae manage to live through the winter to become very destructive Scolytus bark beetles. Now is the time for entomologists to introduce an even more powerful, but eventually useless weapon against the insect world. For more information on the Dutch Elm disease see page 47.



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THE EARTHWORM

A child's appreciation of a garden ally.

By SUSAN BARTLESON

THE earthworm is a small animal that is common to most gardens. It belongs to the invertebrate group of animals, meaning that it has no backbone. Two thousand different species are found in warm and moist regions all over the world. The worm that most people know is a red-brown animal two and one-half to three inches in length. This is not a standard length for earthworms, however, as they can be as small as one twenty-fifth of an inch or as large as six feet. The longer species are found in the tropical regions.

The body of the earthworm is very interesting. It is divided into ninety-two segments or rings. The earthworm has no eyes but has a pair of spots on each segment sensitive to light. Worms are provided with four double rows of bristles, two rows underneath and one on each side. The earthworm pulls itself along by contracting two kinds of muscles. As the worm moves it forms a round burrow. It is said that the earthworm makes slight clicking noises as it makes its burrow, but scientists don't know whether or not worms can communicate by these sounds.

Earthworms are not divided into sexes, but are bisexual, meaning that each one can lay eggs. However, each worm cannot fertilize its own eggs, so it is necessary that two or more worms be present in a culture before reproduction can be accomplished.* The eggs are laid in capsules, each capsule containing from two to twenty eggs. Most capsules will hatch even if they are frozen or dried out. Capsules can be seen by the naked eye. Most eggs hatch from twenty-one to thirty days after they are laid. Eggs seem to hatch best when the temperature is sixty degrees. It is interesting to note that domesticated earthworms produce capsules every five days and wild earthworms only produce them every twenty days. An earthworm reaches maturity in about ninety days, but grows for about two years.

The earthworm lives in the burrow it makes. During the pleasant seasons of the year the worm stays from twelve to eighteen inches from the surface of the earth. When the frost comes, the earthworm burrows below the frost line. In rainy weather the worm blocks up the opening of the burrow with leaves or other material. If the water seeps through anyway, the worm has to come to the top of the earth to avoid smothering because if the worm stayed in the burrow the water would force all the air out. This explains why many worms are seen on the ground after a rain storm. If the burrow becomes too crowded some of the

(Editor's Note — Manure worms are known to lay eggs that hatch without fertilization.*

earthworms migrate. They wait for a damp or rainy night and then come to the top of the earth. They then crawl considerable distances in search of a new home. The greatest danger is that the sun may rise and catch the earthworms on a hard surface through which it cannot dig. If the earthworms skin becomes dry he dies.

The main food of the earthworm is decayed animal or vegetable matter. Manure and leaves would be good organic matter for most people to feed worms. A worm cannot live without moisture, so people should always be sure there is enough moisture to keep the worms alive.

Fertilizing the soil is one of the earthworm's jobs. The earthworm eats its way through the hard layers of soil which it cannot push through. It feeds on the decaying organic matter and as it feeds, the soil and waste matter pass out of the digestive canal and are left on the ground in little heaps called castings. These castings help to enrich the soil. The castings give the soil five times more nitrogen, seven times the phosphate, eleven times the potassium, and 1.55 times more humus content than the same soil with no earthworms present. Without these additions to the soil and the earthworms' burrowing work, we would soon perish because there would be no more plant life. Domesticated manure earthworms often leave their castings underground where the castings help the plant, but wild earthworms leave their castings on top of the soil where they do less good. About eighteen tons of earth pass through an earthworm's body in one year. A million earthworms weigh as much as a truck horse but the worm's combined muscles are a hundred times stronger than a horse's. In addition earthworms fertilize the soil around the roots where a horse couldn't get. There should be about 125,000 earthworms per acre. Along the Nile where some of the world's greatest soil lies, there are eleven million earthworms per acre.

The second job of the earthworm is aeration. By the tunnels it digs the earthworm helps make the soil porous. The soil can then absorb more water. The water in turn helps growing plants reach maturity. Burrowing also brings up to the surface of the earth many trace elements, that are essential to people's well being.

Earthworms can be raised in several ways. After you receive your order of worms you can raise them in boxes or pits. The box should be filled with peat moss, soil and manure. Water the boxes once a week. The boxes should have a covering to keep it dark inside. Food for earthworms can be supplied with kitchen scraps, grass cuttings, dried leaves, and the mixture that was put in the boxes to start the worms. Earthworms can also be placed in a pit outside.

When adding worms to the soil do not pick them out and drop them in the soil. Put them in with the earth they are living in so that the change will not be too sudden.

SUSAN wrote her composition as part of her eighth grade final examination, for each student in the class had been assigned to study earthworms. The topic. "Earthworms" was chosen because the students live in a residential area where inoculation re: Organic gardening could be useful, because the idea was a new one for the group, and because I (the teacher)was well enough acquainted with the facts involved to direct the progress of the work intelligently.

When the assignment was announced it was met with humor, practical jokes, and scoffing on the part of the lively group. But, as the research went on, the attitudes of the students changed. Many became interested enough to start compost piles and to buy earthworms to plant in them. I brought in worms of many sizes, and capsules for the group to examine. Because of their interest most of them forgot to be squeemish.

(Mrs. J. H. Denninger, Watchung, New Jersey)

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Christmas Rose (*Helleborus niger*)

CHRISTMAS ROSE

By WILLIAM H. EYSTER, Ph.D.

COMMONLY called the Christmas rose, *Helleborus niger* belongs to the Buttercup Family (*Ranunculaceae*) which includes such diverse plants as buttercups, meadow rue, hepatica, anemone, clematis, columbine, delphinium, globeflower, baneberry, and hellebore. This cosmopolitan family of plants offers many beautiful flowers for our enjoyment, some blooming in early spring, some during the summer months, some in autumn when the days are growing shorter and cooler, and some in midwinter. It is with the winter-blooming members of this family and more particularly with *Helleborus niger* that this article is concerned.

Helleborus niger grows natively in the shade of trees and shrubs in northern Italy, and other parts of southern Europe. It is commonly called the Christmas rose because its blooming season usually begins before the holidays and extends through and beyond them, and also because the flower resembles a single rose. It grows best in a shaded place where the soil is stony and contains much humus and moisture. But it can endure the summer sun better than the bright light reflected by snow and the biting winds of winter. Against these the Christmas rose should be protected. This can be accomplished most simply by planting it on the off-wind side of evergreen shrubs and trees, and by covering the plant lightly with evergreen boughs during the months of December to March or until the snow disappears.

Time to Plant

The best times to plant Christmas rose is from August until winter and in early spring before much growth has been made. A common mistake with Christmas rose as with the peony is to plant it too late in the spring. Unless planted early, the plants will not build up enough reserve energy to enable them to bloom the following winter so that flowers will not be formed until a year later.

How to Plant

Like peonies, Christmas roses must not be planted too deep and

special care must be taken that the roots are not damaged. The soil should be well prepared with humus and pulverized rocks because a planting lasts for decades. Leafmold and peatmoss are also good materials for further enriching the soil humus.

Time of Flowering

Christmas roses are unique in that they bloom in midwinter when practically all other plants are out of bloom. Not only do these plants provide beautiful winter flowers, but because of their beautiful evergreen leaves they are unexcelled for ground cover. For this purpose, they should be planted in groups of from 10 to hundreds of plants. The leaves are palmately divided. There usually is only one long-petioled leaf, but the flower stem may bear one or more sessile (unstalked) leaves or aborted leaves called bracts. The leaves are leathery and evergreen. The plants have creeping rootstocks. The white flowers are borne on either simple or once-branched stems about twelve inches high so that the flowers are elevated a few inches above the leaves. Common horticultural varieties of *Helleborus niger* include *H. altifolius* or *maximum* which has taller flower stalks and larger flowers, *H. praecox* which blooms as early as October and continues until after the New Year, and *H. niger angustifolius* which has narrower leaves and smaller flowers than the typical Christmas rose.

Indoor Blooms

To be absolutely sure of having plants in bloom at Christmas, one moves strong plants into the greenhouse. Or before freezing weather, entire beds can be brought into bloom for cut flowers by covering them, or plants about to bloom may be balled and placed under a protective covering. If one wishes to sell blooming plants, they should be potted in six-inch pots (or larger pots for the larger plants) in early spring, and the potted plants should then be sunk in the soil to a depth of about five inches in the shade of a high tree and provided with water during the summer. At the proper time in late autumn, the pots must be taken up and put under conditions which will bring them into bloom at the desired time.

Christmas roses do not require high temperatures for forcing. In warm weather, they should be aerated and eventually shaded. After the buds appear, the plants should be kept in the dark for a time. This will insure longer flower stems. Later, however, the plants must be given full light again but not bright sunlight. The forcing of the broad petaled variety must be started somewhat earlier than that of *H. niger* and the early-flowering varieties An experienced gardener will know how to hasten or retard the flowering of the plants, by controlling the temperature. If plants seem to be coming into flower too early, they are exposed to the air during the day or during both day and night. If the plants are developing too slowly, the plants are kept covered and the temperature somewhat higher. If greenhouses are available, the plants can be moved from a warm house to a cold house or vice versa. At temperatures just above zero, the flowers of all forms of *H. niger* remain fresh for many weeks. In some of the forms the flowers assume a yellowish or pinkish tinge as they get older.

The bed of Christmas roses shown is located in Mt. Gretna, Pennsylvania, Lebanon County, in the mountains, and were grown by Mrs. Martha E. Denniston.

The roses are three years old, and have never had any other fertilizer than organic – steer manure. This photograph was taken in January 1950. They started to bloom the first week in November and bloomed continuously to the last week in March. When the snow is on the ground two to four inches, it is a beautiful picture to see the white blooms stick their heads above the snow and love it. No matter how cold it is even below zero the petals never freeze. It is one of the most beautiful and interesting flowers ever grown in a flower garden.

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ORGANIC GARDENING
Dept. 12-G, Emmaus, Pa.

Answer to our critics

(*Continued from page* 13)

eva Experiment Station gave the results of a fertilizer experiment on grapes that ran for several years. They used different amounts of various types of chemical fertilizers. They received practically the same tonnage of grapes from the plot with no fertilizer as they did from those that had been fertilized. In fact one year the check plot with no fertilizer had the biggest yield! In no case was the yield increased anywhere near enough to pay for the fertilizer and cost of applying it."

Robert Van Vechten
Vine Valley,
Middlesex, N. Y.

In Italy although their soil has been farmed for 4,000 years, peasants in the Po valley regularly get 60 bushels of wheat a year to the acre; where in the United States the average for 1944, a fairly good year, was 18.8 bushels per acre. The fact of the matter is that the United States is at the very bottom of the list of 19 wheat exporting countries as far as acre yields are concerned. On the average those other countries use far less chemical fertilizers than we do. Italy, for example, is practically at the bottom of the list as to chemical fertilizer usage.

A certain aspect of yields must be discussed in order to show the effects of chemical fertilizers on agricultural production. With chemical fertilizers there has come in an increasing usage of poisonous insecticides. I could fill up twenty pages like this with references from the agricultural literature showing how diseases in plants come through the use of chemical fertilizers. They also create certain imbalances which encourage insect infestations. Due to the increasing amount of poison spraying certain beneficial insects have been discouraged. Let me quote from a letter sent to the *Scientific Monthly* by Paul D. Harwood of Ashland, Ohio:

Bees and Clover

"Furthermore, questions of considerable economic importance are forcing us to reconsider today the bee-clover relationship, for we find that yields of legume seeds, including red clover, have declined until the situation is acute. Large research programs have been established to discover the reason for these falling yields. It is nearly a hundred years since Darwin found, quite correctly, that 20 heads of insect-pollinated clover yielded 2,290 seeds, whereas 20 protected heads yielded not one. Investigators are seeking ways to obtain consistently those high yields. Prominent in the research program is the relationship of the bee to the clover, for that relationship is not wholly understood, even today. In the absence of sufficient wild insects to pollinate the clover, it is of critical importance that we understand better the erratic behavior of the honeybee. Darwin's observations on the subject are still valid, although his interpretations may fall a little short of perfection."

There are many hidden factors, such as the bee and other beneficial insects that are affected by the use of chemical fertilizers, which are going to reduce yields more and more as we go along.

(*To be Continued*)

ORGANIC FOOD DIRECTORY

ORGANIC GARDENING *invites all who have organically grown foods for sale to list them in the* ORGANIC GARDENING Directory. *There is no charge for listing your name, address, and organically grown produce in this directory. Write us, telling in detail what you have that is organically grown, mentioning how long and in what manner you have applied the method. We will also register those who have a place where people could stay over-night and get organically produced food. Write to*

Organic Food Division
ORGANIC GARDENING, Emmaus, Pa.

Mulching care

Look over your mulches this time of year to avoid root exposure. Why not carry with you a bucket of mulching material, like sawdust, hay, or other organic matter to replace any part of the mulch which severe weather may have disturbed.

Pruning grape vines

Old fruit trees, long neglected, can often be brought back into good production by a careful pruning job in December. When the branches are fully exposed, the dead and diseased wood can easily be seen.

Dandelion

In some parts of Europe, the root of the Dandelion is used as a substitute for coffee much the same as the familiar Chicory.

A Substitute for Spinach

A new green vegetable from Java threatens to push faithful old spinach right off the American dinner table. The vegetable is called Florida spinach, but in spite of its name, will grow over most of the United States. It is low in fiber and high in vitamins, and tastes better than regular spinach. Best of all, it has no oxalic acid, the chemical which makes spinach and beet greens hard for some people to digest. It will probably appear in next year's seed catalogs.

French Endive

You can winter strong healthy roots of French endive by just leaving them in the ground in the open garden. Hand freezing will not injure these roots. Dig the roots in the spring when you are ready to force them.

Plan Ahead

It's a good time now to make complete planting plans for your next year's garden. Get everything down on paper while you still remember the mistakes you may have made this past season, so that you won't make them again next year. You'll also be all ready to go ahead with your ordering when next month's new catalogs come out.

Garbage Treatment

Kitchen refuse from each meal, if well dusted with Cayenne pepper when scraped into the kitchen garbage can, will not attract rats or domestic animals. In hot weather, keep all weeds and grass cuttings in bushel baskets to throw over the garbage. If flies start to appear, dust the top of the heap with lime. If a neighbor's rat comes around, he just takes one sniff and runs away.

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HINTS for the FLOWER GARDEN

Mum Protection

In the fall or early winter cut back the stems of chrysanthemums close to the ground. If brown foliage appeared during the past summer, dispose of the stems and dropped leaves — they harbor insects. Cover with a blanket of evergreen branches intermingled with leaves. Apply when the soil is slightly frozen.

Azaleas

If you have greenhouse purchased azaleas outdoors and live north of Philadelphia, Pennsylvania, by all means bring them indoors before the really cold weather of January and February sets in. These florists' potted azaleas are not winter hardy in the northern states. In the south, such plants if protected the first winter with a loose covering of leaves, retained in place with a circular wire fence, usually come through in fine shape. Be sure the protective covering of leaves is loose enough to allow air circulation.

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Prices of other sizes on request.

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Mulching

In mulching azaleas and rhododendrons, oak leaves, pine needles or acid peat moss should be used. Do not use maple leaves. They tend to pack closely when wet, thus keeping air from the plant roots. When very tightly packed they frequently "cake" and have been known to kill azaleas for this reason.

Perennials

Remember, it is always best in colder regions, to give some protection to all newly planted perennials. The first winter is often difficult for even the very hardy species. A mulch of salt hay, peat moss, evergreen branches, or corn stalks are satisfactory. Apply the mulch loosely, so as not to smother the plants. Also, do not put on until after the first hard frost.

Climbing Vines

Did you know the climbing vines have definite patterns of growth. Actenidia, for instance, always twines from left to right, and honeysuckle from right to left — and many others are just as fixed in their notions.

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Rudolf Steiner

(*Continued from page 26*)

after a short time. The full effect of the methods, however, appears in the course of three or four years. It consists in the continuous increase in the fertility of the soil and in an improvement of the quality and flavor of the produce. Both the plants and the soil in which the forces of life are stimulated are found to provide themselves *actively* with the required substances by attracting them from the surrounding circuit of forces, just as a healthy organ in the body supplies itself actively with what it needs from the circulating blood and the other juices of the body.

Many reports from various countries, even including those with hot climate, enumerate the good results obtained by the described methods and have made R. Steiner's name known. They all bear witness to the fruitfulness of the measures which have their origin in his investigations. They provide plenty of material for the building of a new and more comprehensive science of life. They also prove invaluable for the efficient *handling* of the farm organisms as a living and self supporting entity. It may even be said that the task of the farmer and gardener assumes a new dignity because he deliberately contributes to the regeneration of the earth.

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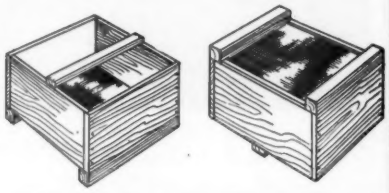
(5) "Bio-Dynamic Farming and Gardening," by E. Pfeiffer. American Edition, Anthroposophic Press, New York, N. Y. English Edition, under the title: "Soil Fertility, Renewal and Preservation." Faber & Faber, London, 1946. "The Earth's Face and Human Destiny," by E. Pfeiffer. Rodale Press Emmaus, Pa. 1947.

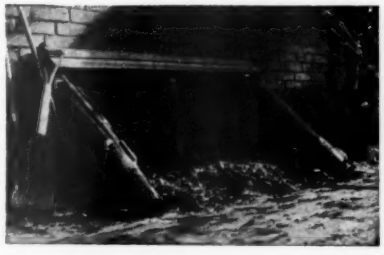
Gadgets for the Garden

Make a box about one foot wide, eighteen inches long, and one foot high, using ordinary window screening for the bottom. Add a short, narrow board across the top for a handle. Then after heaping vegetables in it from the garden, you can turn the hose on the box, washing off the mud and soil before bringing the vegetables into the house. It saves a great deal of muddiness in the kitchen.



We attach the screen by means of scrap molding – any narrow board will do. We secure the screen to the underside with short lengths of 2" by 2". They serve also as legs, too, allowing the water to run freely from the bottom.

A "lean-to" pit built somewhat as shown in the photograph is easily filled with leaves. The brick wall holds and reflects heat even after sundown, so lots of water is needed. A few earthworms in the pit will do wonders, turning out leaf mold in practically no time.



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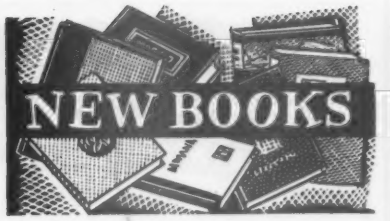

PLANT AND ANIMAL GEOGRAPHY (2nd Edition) by Dr. Marion I. Newbigin. (Revised by Prof. H. J. Fleure) (E. P. Dutton & Company, Inc., Publishers, 300 Fourth Avenue, New York, New York. 1948)

This book represents a geographer's study of the relation between living things, both plant and animal, and the land they inhabit. It begins with a discussion of the terrestrial plant cover and its significance; the elements of plant and animal classification; and influence of soils, climatic factors, and changes in climate on vegetable and hence animal life. Consideration is given to the major types of plant community—forest, grassland, desert—and their animal associates. Cloth bound, 298 pages, with 39 illustrations.

THE MAPLE SUGAR BOOK by Helen and Scott Nearing. (The John Day Company, Inc., 2 West 45th Street, New York, New York. 1950 $3.75)

This book is a plain and practical account of the art of sugaring by two modern pioneers who took to the Green Mountains more than fifteen years ago. Here, for the first time, is presented the whole body of information on a romantic and profitable business. It is an interesting story of homesteading and how to live. This story of mapling will appeal to all who love the woods and have an interest in the products of the maple trees.

LET'S LIVE AT HOME—A Guide to Family Living by Irvine H. Milgate and Rachel W. Milgate (Harper & Brothers, Publishers, 49 East 33rd Street, New York, New York. 1949 $2.50)

This book tells the story of how one family gained self sufficiency and security by starting with a hive of bees and a backyard vegetable garden. Not the least important by-product of the experiences recorded was the fresh sense of family unity and interest developed between parents and children. Many valuable suggestions are given for heating, lighting, space arrangement, daily schedules for family jobs, amusements for rainy days, and valuable helps on sub-zero storage of foods. Cloth bound, 180 pages.

McFarland

Lilium philippinense formosanum

BULB OF THE MONTH

One of the best lilies for California

CHARLOTTE M. HOAK

ONE of the favorite lilies for planting in our sunny borders is the white trumpet lily which comes from the island of Formosa. It is one of the last of the lilies to bloom, the late types coming into flower about Thanksgiving time, long after the other lilies have passed out of bloom.

The tiny bulbs bloom the first year from seed; and, if this seed is sown as it ripens, you will have plants in bloom the next fall. The seeds germinate readily, in fact, this lily is much easier to raise from seed than some of our perennials.

Though short-lived, this lily is one of the best for this region. Plant eight to nine inches deep as the bulbs have vigorous stem roots which anchor them so that they rarely need staking. The second year the stalks are strong and vigorous, and often produce eight to ten blossoms on each plant. Be careful to get good stock, for this fine lily is very prone to develop the fatal lily mosaic. Raise your own, for seedlings do not develop any of the virus diseases.

How to Grow Amaryllis?

Q. For two years now I have ordered amaryllis bulbs, planted them according to the printed advice of the grower, and seen them start into a growth only to be quickly disappointed. They made two large and weak leaves, but no flowering stalk at all. Several even failed to produce leaves, they stayed firm and healthy, made a few roots and stopped. Should I keep on watering them and get them to produce later or should I rest them for the time being?

A. Many of our amaryllis bulbs, occasionally called hippeastrum, are grown in the Northwest where moisture conditions are by no means ideal for these plants which want a warm summer. When they are shipped, they have fleshy roots and are not really fully dormant. You plant them according to directions and keep on watering them until the roots are shrivelled up. Instead of getting good leaves, you get a flower which exhausts the bulb, and the poor root system produces only weak leaves. This series of troubles is probably emphasized further by indoor conditions, which inevitably are too warm at first. Amaryllis bulbs should be started at about 60 degrees Fahrenheit, but this temperature is hard to find in the average house and certainly on the average window sill. Those which have not sent forth either flowers or leaves are probably your most promising bulbs since they experience a protracted rest period. If they were soft, they would be poor, but since they have remained firm you can look forward to a good bloom when they resume active growth. Keep them on the dry side lest your soil become sour and give them some compost water or liquid manure when they begin to send up the flowering scape or leaves. The large leaves you mention may be due to the variety. Perhaps those are *Amaryllis longiflora,* though not necessarily so.

Summer Care of Amaryllis

Q. Where should pots of amaryllis plants be kept during the summer?

A. Be sure to put your amaryllis plants in a location which has morning sun only. They should be well-watered and fertilized until the leaves begin to die back.

Hardy Bulbs

Q. The lily seeds that I planted last autumn came up this spring and have grown into healthy-looking seedlings. Should these seedlings be taken up? If so, when should they be replanted, and at what depth?

A. If the lilies are hardy and able to spend the winter in the soil without freezing they need not be taken up this fall. If it is desired to space them out or transplant them into another part of the garden, they should be taken up when the leaves begin to lose their green color and give other evidence of the end of the season's growth. In transplanting, the bulbs should be planted at a depth which is equal to about three times the height of the bulb. As the bulbs grow larger in subsequent years, contractible roots will pull the bulbs deeper into the soil until they reach the depth which is best suited to that particular kind of lily.

(*Continued on page* 64)

Friends of O. G.—Please Note

I intend to take a trip through Florida this coming January, and I am wondering if any of our readers have things of interest that they think I ought to see from a farming and gardening viewpoint. Would be glad to hear from readers.

J. I. Rodale

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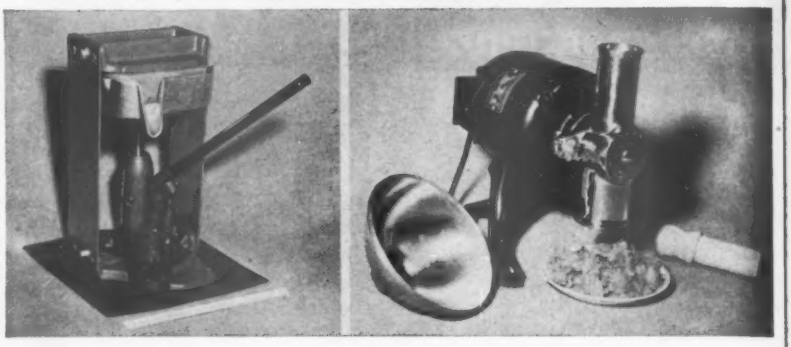
To qualify for the prizes listed on these pages, just write up your experiences in gathering organic material for your garden—where you get it, what kind of material you get, how much is available, and any other pertinent information.

The contest closes January 15. All entries become the property of ORGANIC GARDENING. They will be judged on originality, neatness, and general content. Decision of the judges will be final.

You don't have to be a professional writer to win! Just write up your experiences in 500 words or less and send them to the Contest Editor, ORGANIC GARDENING, Emmaus, Pa. Winners will be notified by mail. Use typewriter if possible. The contest is not open to ORGANIC GARDENING, THE ORGANIC FARMER, or PREVENTION employes or their families.

FIRST PRIZE



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The K & K Juicer gives you fruit juices that are more nutritious, more palatable and delicious to consume. Donated by

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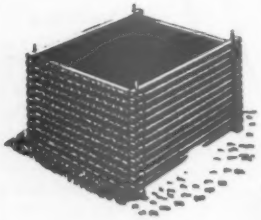
One hundred pounds of Greensand marl, safe source of potash and more than 20 trace elements. Donated by National Soil Conservation, Inc., 90 West St., New York City 6, New York.

SECOND PRIZE



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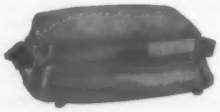

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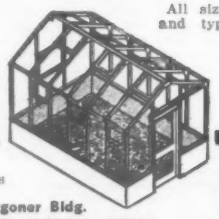

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HONEY: Delicious Florida orange blossom, 2½ lbs., postage paid $1.00. 10 lbs. postage paid $3.75. **NELSON L. WHEELER, St. Cloud, Florida**

Crude Black Cane Molasses, nothing added, nothing taken away. Half gallon trial order, $1.75; postpaid east of the Mississippi. Send card for price list. **J. S. RILEY & CO., New Castle Pa.**

FOR BETTER HEALTH—SESAME SEED—ready to eat—Nature's digestible complete protein. Rich in Calcium, vitamins, Lecithin. **FRESHLY HULLED SESAME SEEDS** 3 lbs. $2.00. Sunflower Kernels, 1 lb. $1.60. Proso Hulled Millet 2 lbs. $1. add postage. Literature, Nutritional value of Sesame with order. Free Price List. **HARRISON ORGANIC FOODS, 1028 E. Landis Ave., Vineland, N. J.**

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New wonderful Energy and Body Building 4 grain Cereal for mush. Millet, Corn Meal, Brown rice, Wheat germ, ground Almonds. Another ready to serve Vita Cereal, Wheat germ, Almonds, Cocoanut, Wheat flakes. We make Diabetic Cereal also. Free Alkaline Acid forming chart. Send stamp for folder. **THE MILL, Box 699, Lodi, California.**

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MAKE MONEY RAISING ANIMALS AT HOME!!! Money making secrets and successful short cuts. All animals. Big 17 lesson book. **BONUS,** Two extra money making plans. $4.00 value, only $3.00 postpaid. **ALHACO—West Salem 4, Illinois.**

For Information about MELBOURNE VILLAGE, a planned community of productive homes and creative living with special emphasis on Organic Gardening. Write **AMERICAN HOMESTEADING FOUNDATION, Box 696, Melbourne, Florida.**

Distributors: Wanted for each locality in all communities of States East of the Mississippi River. Write for particulars on a new Organic product to be put on the market in 1951. **ORGANIC GARDENS—Fullerton, Md.**

FREE BOOK "505 Odd, Successful Businesses." $250 Week reported! Work home. Expect something Odd! **PACIFIC, Oceanside, California.**

Wanted—Distributors for Processed Organic Fertilizer. Write to **SOILBUILDERS, Inc., Box 176, So. St. Paul, Minnesota.**

DISTRIBUTE SUBSCRIPTION-GETTING BOOKLETS. Help spread the organic message. Nothing to sell. Merely hand out these booklets to likely subscriber prospects of **Organic Gardening Magazine.** Coded coupon permits us to trace source of subscription to your efforts. Liberal commission **See page 3 for complete story.**

FOR SALE—All modern, all Organic Processing Plant, enough material to last for years. For information write to **Apartment 1, 4561 Minnehaha Ave., Minneapolis, Minn.**

LECTURES

GARDEN CLUBS OF THE SOUTH! ANNOUNCING! Lecture Tour by Philip S. Wells, F.R.H.S., dynamic lecturer, traveler, photographer, organiculturist! Your opportunity to meet this engaging and energetic organic gardener, hear his fascinating "Gardening With Bacteria," "Gardening With Earthworms" and "Gardening Without Digging." illustrated with personal Kodachromes of English Gardens in the month of May, including some of Winston Churchill's farm-estate "Chartwell." Mr. Wells is a Fellow Royal Horticultural Society (England) and President and Founder The South Jersey Organic Gardeners' and Farmers' Club. Florida and adjacent States visited between January 15th and 27th. Write for particulars: **PHILIP S. WELLS, 24 Seventh Ave., Haddon Heights, New Jersey.**

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NOW IN IRELAND conferring with the AVOCA HANDWEAVERS; hunting new things like those museum-beautiful ARAN SWEATERS. What can I do for you! **CAROL BROWN, Putney 34, Vermont.**

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Young man (single preferred) to enter as partner in Organic goat farm. Small capital required. Write **Box GF, ORGANIC GARDENING, 46 S. West St., Allentown, Pennsylvania**

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IT'S NO SECRET!!! America's finest families are sending their silver to us for repair and silverplating service. Free estimate and literature. **DETROIT SILVERSMITH COMPANY, 19944 Livernois, Detroit 21, Michigan.**

Unpainted figurine and plaque list, with painting directions, 10¢. Lovely tropical hibiscus plaque, 59¢ pp. Wholesale accounts solicited. **FLORIDA GIFTERS, Box 854, Little-River, Fla.**

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Frozen Strawberries, Blackberries and most vegetables. 100% Organic. Chain store prices. **BERT AND SHIRLIE BOWEN, 25019 Power Road, Farmington, Michigan. Phone Farmington 0473J.**

ORGANICALLY-GROWN Solar Nectar Navel oranges grown in rich soil of Sierra foothills, mulched with organic materials and supplemented with natural minerals from Death Valley which contain healthful properties known for healing diseases in human beings and plant life. Results are some of the finest oranges we have ever grown. Can keep 200 more customers supplied this season. Get your name on the list. Satisfaction Guaranteed. Motto: My obligation ceases only when you eat the fruit and like it well enough to buy it again. $5.00 box (1 2/5 bu.) F.O.B. wholesale or retail. Shipping season—December through March. **HENRY CARDELL, Lincoln, California.**

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Organically Grown SUNFLOWER SEEDS. Ripened and cured in the field. 24 oz. for $1.00. Add 10 per cent West of the Mississippi. **ELMIRA EYSTER, Emmaus, Pennsylvania.**

Pure Vermont Maple Syrup, organically produced. A Christmas gift of good taste. Gallon $5.95; ½ gallon $3.40; quart $1.95. Postpaid. **JOHN BACON, Johnston, Vermont.**

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ORGANICALLY GROWN WHEAT processed into 100% whole wheat and cereal containing all the original vitamins and mineral salts of the wheat berry. Trial 5 lb. bags of flour or cereal sent postpaid for $1.00. **LOUHELEN RANCH, Davison, Michigan.**

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NATURE'S OWN HASTENER—MORE BACTERIA, VITAMINS, HORMONES, MINERALS, AND TRACE ELEMENTS HAVE BEEN ADDED TO B.C.A.

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- **B.C.A. contains, hormones, vitamins, minerals and bacteria in proper proportions for optimum enzyme production.**
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- **B.C.A. contains the trace elements lacking in many soils and so necessary for best results.**
- **B.C.A. is a neutral culture prepared with conditioning food for the bacteria in a rich peat base.**

"ALL ORGANIC ** NO CHEMICALS"

DON'T burn your leaves, grass cuttings, garbage, plant residues, green matter, citrus skins, fish wastes, etc. Mixed in a compost heap as directed along with B.C.A. will give you the best fertilizer in the World.

You will be amazed at the increased growth of your plants, the richness of your soil; the perfect aeration and drainage all realized wth the use of B.C.A. in composting and sheet mulching. Use B.C.A. direct to potted plants as a top dressing, etc. Carefully described in our free literature.

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Larger sizes on request.

A unit of B.C.A. is sufficient for approximately ½ to 1 ton of compost.

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CITY ..... STATE .....

Readers' Correspondence

(*Continued from page 59*)

Winter Care of Lily Seedlings

Q. What care do lily seedlings need over the winter?

A. If your lilies are hardy varieties, the seedlings may be left in the ground and mulched over the winter. If they are not hardy, the young bulblets should be lifted out as soon as the leaves dry and should be stored for the winter. In the spring you can set them just as you would any other bulb. In planting, place them about three times their height in the soil.

Pruning Peonies

Q. When should peonies be pruned back?

A. Peonies should not be cut down until the leaves begin to die in the fall. If they are cut down much sooner, the plants will be starved and weakened the following year.

Q. When ground seed is used as a fertilizer, how soon do the nutrient and mineral elements become available in the soil?

A. It probably takes at least three months for some of it to begin to become available.

NOTICE

In the seminar on phosphate (page 40, August issue) it was incorrectly stated that Colloidal phosphate is most widely sold under the commercial brand names of Se-Bo-Phos and Sea-Coll. Mr. Will Hoover of the Hoover Soil Service, Gilman, Illinois, has been handling national distribution of this product for a number of years and has been a continual advertiser in *ORGANIC GARDENING*. Mr. Hoover has done a lot of pioneer work where colloidal phosphate is concerned *and has done much to prove the* value of this product.

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Editorial Staff.

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Native Shrubs for Ornamental Plantings

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HOLLIES are without doubt among the most beautiful ornamental plants, especially in winter. The leaves are glossy green, and the fruits are colorful. *Ilex crenata* is a large evergreen shrub with a most interesting informal habit and resembles boxwood. *I. opaca* grows, under natural conditions, into a small tree but may be planted as a hedge or ornamental tree. It grows natively in moist woodlands along the eastern coast of the United States and as far west as Missouri. It is one of the most beloved trees of the South and is hardy as far north as Massachusetts. Male and female plants should be set out near each other to produce berries on the female trees. The red berries and shiny leaves are symbols of the Christmas season.

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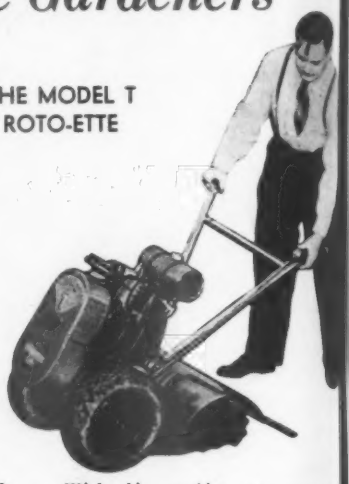

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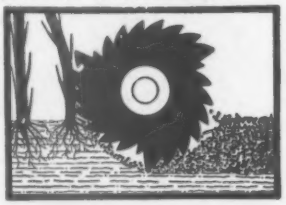

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Not only will this amazing machine prepare your garden for planting in one simple operation!

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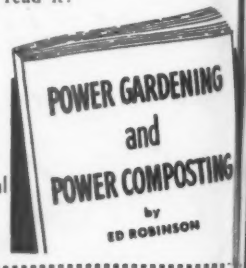

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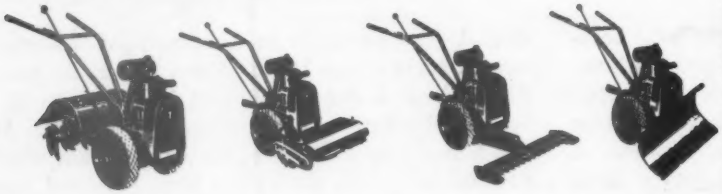

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